DRAFT

CORRECTIVE MEASURES STUDY OPERABLE UNIT NO. 2 (OU2)

Omaha Shops

Prepared for
Union Pacific Railroad Company
Omaha, Nebraska

UNION PACIFIC

ENVIRONMENTAL MANAGEMENT

February 2006

URS
12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154

CORRECTIVE MEASURES STUDY
OPERABLE UNIT NO. 2

UNION PACIFIC RAILROAD
OMAHA SHOPS

Union Pacific Railroad Company
1400 Douglas Street STOP 1030
Omaha, Nebraska 68179

CERTIFICATION

"I certify that this document and all attachments hereto were prepared under my direction or supervision. To the best of my knowledge, information and belief, the information submitted is true, accurate, and complete. I am aware that there are criminal penalties for knowingly providing false information."

Signature: Jeffrey D. McDermott

Name: Jeffrey D. McDermott

Title: Mgr. Environmental Site Remediation

Date: February 20, 2006

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Tables

List of Figures

TABLE OF CONTENTS

List of Appendixes

ACBM	Asbestos-Containing Building Materials
ACM	Asbestos-Containing Material
AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	Corrective Measures
CMS	Corrective Measures Study
COPC	Chemical of Potential Concern
HI	Hazard Index
ID	Inside Diameter
IM	Interim Measures
LTU	Land Treatment Unit
msl	mean sea level
NCP	National Contingency Plan
NDEC	Nebraska Department of Environmental Control
NDEQ	Nebraska Department of Environmental Quality
NET	National Environmental Testing
O&M	Operation and Maintenance
OD	Outside Diameter
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
PA	Preliminary Assessment
PAHs	Polycyclic Aromatic Hydrocarbons
PCE	Tetrachloroethylene
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	parts per million
PRGs	Preliminary Remediation Goals
QA/QC	Quality Assurance/Quality Control
RAPMA	Remedial Action Plan Monitoring Act
RBCs	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RfD	Reference Dose
RFI	RCRA Facility Investigation

RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCEM	Site Conceptual Exposure Model
SCS	Soil Conservation Service
SF	Slope Factor
SVOCs	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TBC	To Be Considered
TEH	Total Extractable Hydrocarbons
TMV	Toxicity, Mobility, and Volume
TRPH	Total Recoverable Petroleum Hydrocarbons
TSA	Temporary Storage Area
TWA	Time-Weighted Average
TRW	Technical Review Workshop
UCL	Upper Confidence Limit
UPRR	Union Pacific Railroad Company
URSGWC	URS Greiner Woodward Clyde
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
WWTP	Waste Water Treatment Plant

1.1 AUTHORITY

The Union Pacific Railroad Company (UPRR) Omaha Shops encompass approximately 184 acres lying north of downtown Omaha, Nebraska and just west of the Missouri River (Figure 1-1). The Omaha Shops are the subject of an Administrative Order on Consent (Order) under Section 3008(h) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. In response to the Order, UPRR has contracted URS Corporation (URS) to complete a Corrective Measures Study (CMS) at the Omaha Shops.

Based on the results of the RCRA Facility Assessment (RFA) (Tetra Tech 1998) and the Omaha Shops' former classification as an interim status RCRA storage facility, the Omaha Shops are the subject of an Order which includes the following facility-wide objectives:

- Evaluate the need for Interim Measures (IM) at the Omaha Shops to address contamination to relieve threats to human health or the environment
- Perform IM that are necessary to control contamination at the Omaha Shops or to relieve threats to human health or the environment, or to prevent or minimize the spread of contaminants while long-term corrective measures are being implemented
- Perform a RCRA Facility Investigation(s) (RFI) to determine the nature and extent of any release of hazardous waste or hazardous constituents at or from the Omaha Shops
- Perform a Corrective Measures Study(ies) (CMS) to identify and evaluate alternatives for the corrective measures necessary to prevent, mitigate, or remediate any releases of hazardous wastes or hazardous constituents at or from the Omaha Shops
- Implement necessary corrective measure(s) at the Omaha Shops
- Perform any other activities necessary to correct or evaluate actual or potential threats to human health and/or the environment resulting from the release or potential release of hazardous waste or hazardous constituents at or from the Omaha Shops

1.2 OPERABLE UNITS

The Order includes provisions to divide the Omaha Shops into three operable units for ease of administration and to accelerate corrective measures in certain areas. The operable units are shown on Figure 1-2 and include the following:

- Operable Unit No. 1 (OU1) includes surface soils above the normal high water table within the portion of the Omaha Shops that was acquired by the City of Omaha for development of a public-use building project.
- Operable Unit No. 2 (OU2) includes surface soils above the normal high water table within the portion of the Omaha Shops not included in OU1.
- Operable Unit No. 3 (OU3) includes the groundwater underlying the Omaha Shops, at the normal high water table and below.

The Omaha Shops property has been the target of several development proposals since 1987. These development proposals have included public recreational facilities, mixed-use commercial/residential developments, and heavy industrial facilities. Dividing the Omaha Shops into three operable units recognized the potential for development and provided the flexibility to facilitate the City of Omaha's convention center and arena schedule requirements in OU1.

1.3 PURPOSE AND SCOPE

The purpose of this report is to address the requirements of the Order for a RCRA CMS Report for OU2 at the Omaha Shops.

The OU2 RFI addressed four Solid Waste Management Units (SWMUs) and six Areas of Concern (AOCs) as specified in the Order (USEPA 1999). The term SWMU is normally restricted to active sites, but because the exact locations within some of the sites where waste was generated are difficult to define, inactive sites were identified as SWMUs. The ten OU2 RFI sites are identified in Table 1-1.

The purpose of this CMS Report is to briefly summarize the data and to update the current conditions at OU2 and known nature and extent of contamination as documented by the RFI Report. The document will present the CMS screening and evaluation process and propose a corrective measure technology that addresses the contamination in soils at OU2 for use only as commercial or industrial activities. No residential uses are evaluated for this CMS.

1.4 LOCATION AND DESCRIPTION

The Omaha Shops are located at 9th and Webster Streets in Omaha, Douglas County, Nebraska (North 41°15'58" latitude, West 95°55'40" longitude). The legal description of the facility is Township 15 North, Range 13 East, Section 22. The Omaha Shops encompass approximately 184 acres located just west of the Missouri River in an industrialized area of downtown Omaha (Figure 1-1). The OU2 area is approximately 51 acres of the Omaha Shops property.

The site consisted of various buildings and production support areas, each having a function in past operations of the facility. SWMUs and AOCs are shown in Figure 1-3. Currently, the only operations at the Omaha Shops consist of a classification yard and associated office building.

1.5 OPERATIONAL HISTORY

The Omaha Shops were in operation for approximately 100 years, with principal functions as a railroad fueling facility, repair shop, paint shop, and car body repair shop for UPRR's locomotive and car fleet.

UPRR used steam engines from the 1860s until the mid-1950s. The original steam engines were fueled by burning wood, coal, oil, fuel oil, and petroleum-based fuel. They required little lubrication and had no electrical components. In the mid-1950s, diesel power became the predominant source of power for train locomotives. During that time, the entire facility was converted from handling steam engines to diesel engines.

From the 1950s to 1988, the site was a major overhaul and maintenance facility for UPRR. In 1988, most of the operations, except the Print Shop and the Car Shop, moved to Little Rock, Arkansas. After the operations were moved in 1988, facility demolition began.

Specific operational history for OU2 is detailed in the RFI Report (URS 2001).

1.6 PREVIOUS INVESTIGATIONS

1.6.1 PCB Survey

In 1987 and 1988, USPCI completed a PCB electrical transformer fluid survey at the Omaha Shops. According to the survey results, 57 transformers were identified as containing PCB fluids. Concentrations ranged from 0.3 parts per million (ppm) to 932 ppm PCBs. At the time of the survey, 12 of the 57 transformers were in service; three of the 12 transformers contained PCBs at concentrations greater than 240 ppm (241, 254, and 440 ppm), and the remaining nine transformers had PCB concentrations of less than 60 ppm (49, 48, 51, 56, 46, 52, 39, 48, and 51 ppm). The remaining 45 transformers identified as containing PCB fluids were removed from service or disposed of by USPCI (USPCI 1988a).

1.6.2 Asbestos Survey

SOS International completed an asbestos survey of the Omaha Shops in 1988. SOS collected 14 samples of suspected asbestos-containing building materials (ACBM). Six of these samples tested positive for asbestos with concentrations ranging from 35 percent to 90 percent chrysotile asbestos. Ten samples were collected from the outside steam line insulation. Five of these samples contained asbestos. Pipe insulation was examined in the North Locker Room and one sample was collected. The sample contained 90 percent chrysotile asbestos. The Power House pipe insulation and boiler area sampling involved collecting two samples, both of which were found not to contain asbestos. A spray-applied material observed on the walls of Store No. 2 was suspected of containing asbestos, and one sample was collected. This sample was found not to contain asbestos (SOS 1988).

All ACBM was removed and disposed of prior to building demolition.

1.6.3 Preliminary Site Assessment

USPCI completed a preliminary site assessment of the Omaha Shops in 1988. The assessment included a facility walk-through and historical records search. Results of the survey identified a number of current and historical areas which were considered to be areas of potential environmental concern (USPCI 1988b). No action was taken as a result of the Preliminary Site Assessment. Information gathered in the report was used in the planning of subsequent activities.

1.6.4 Fuel Recovery System

A diesel fuel recovery system was installed in 1988 by Terracon after diesel fuel was discovered on the groundwater near the south end of the Omaha Shops during construction of the Abbott

Drive overpass. A total of 13 recovery wells were installed at depths of approximately 27 to 28 feet (Terracon 1988).

1.6.5 Site Investigation

HDR completed a Site Investigation of the Omaha Shops in 1989 and 1990 as a follow-up assessment to the USPCI preliminary site assessment. Field investigations included hand auger borings, truck-mounted drill rig borings, monitoring well installation and sampling, and soil vapor analysis. The site investigation report, dated April 1990, focused on the following areas, some of which are identified as SWMUs or AOCs in the Order:

Area	SWMU or AOC
• Blue Building	SWMU 4
• Car Shop	SWMUs 16 & 17
• Wheel Shop	SWMUs 13, 22, & 23
• Babbitt Shop	SWMU 3
• Traction Motor/Locomotive Shop	SWMU 6
• Roundhouse	SWMU 1
• Acetylene Pit	SWMU 11
• Eighth Street Yard	AOC 10
• Grace Street Yard	AOC 14
• Grace Street Tank	AOC 13
• Car Demolish Area	AOC 12
• Car Dismantle Area	AOC 8
• Oil Pipeline	AOC 16
• Open Drum Storage	SWMU 24
• Temporary Hazardous Waste Storage Area	SWMU 8
• Transformer Storage Area	SWMU 15
• Wastewater Treatment Area/Fuel Storage	SWMU 3, AOC 3

Petroleum hydrocarbons, lead, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and asbestos were detected at the following locations:

- Petroleum hydrocarbons were detected in the following areas:
  - Stores No. 2
  - Wastewater Treatment Area/Babbitt Shop
  - Traction Motor Shop

  - Oil Tanks/Pump House
  - Grace Street Tank
  - Oil Pipeline (selected locations)
- Soil lead levels exceeded 1,000 ppm in the following areas:
  - Babbitt Shop
  - Paint Barrel Pits (also exceeded EP Toxicity levels for lead)
  - Open Drum Storage Area North
  - Eighth Street Yard South
- SVOCs and VOCs were detected at several areas.
- Asbestos was detected in the Car Dismantle Area and Open Drum Storage Area.

1.6.6 Phase II Site Assessment

In 1992, part of the Omaha Shops became a candidate site for an automotive assembly facility. A Phase II site assessment was completed in the Construction Area of the proposed automotive assembly facility. The fieldwork for 19 soil borings was completed during February and March 1992 (W-C 1995). Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, petroleum hydrocarbons, metals, and asbestos. The low levels of VOCs, SVOCs, pesticides/PCBs, and TPH detected in the soil samples from the Construction Area were determined not likely to represent a serious threat to human health or the environment. Similarly, most of the metals detected in the soil samples from the Construction Area were present at concentrations that were determined not likely to represent a serious threat to human health or the environment.

1.6.7 Remedial Action Plan Monitoring Act

In January 1996, UPRR applied to participate in the Nebraska Remedial Action Plan Monitoring Act (RAPMA) Program. The RAPMA Program, authorized by the Nebraska Legislature in 1994, allows NDEQ to coordinate and oversee efforts by property owners, prospective buyers, lending institutions, or others wishing to initiate voluntary environmental cleanup activities. As part of the RAPMA Program, UPRR submitted a draft remedial action plan to NDEQ in January 1997 to describe potential development activities for the Omaha Shops (W-C 1996). The plan described remedial action objectives and activities to be undertaken to redevelop the Omaha Shops facility for commercial use. UPRR decided in March of 2003 to withdraw from the RAPMA Program due to a duplication of efforts between the NDEQ and the USEPA.

1.6.8 USEPA Studies

In 1995, the United States Environmental Protection Agency (USEPA) contracted Tetra Tech Inc. to conduct a RCRA preliminary assessment (PA) at the Omaha Shops. Tetra Tech completed a preliminary review and visual site inspections in July and August of 1995. An additional site visit was completed in July 1997. Based on the preliminary review and visual site inspections, an RFA was prepared in June 1998 (Tetra Tech 1998).

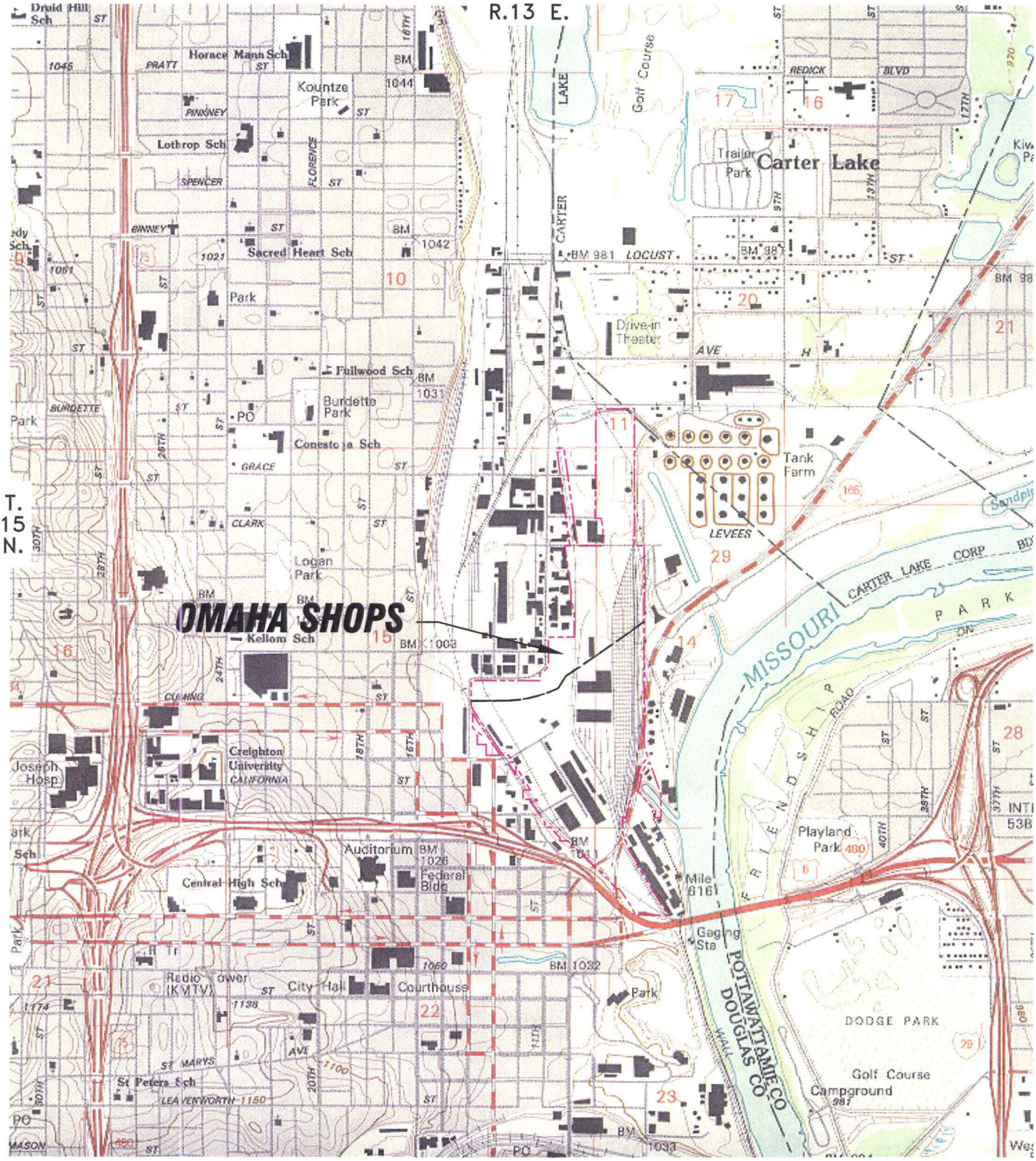
1.6.9 OU2 RCRA Facility Investigation

A RCRA Facility Investigation (RFI) was completed for Operable Unit No. 2 (OU2) at the UPRR Omaha Shops addressing four SWMUs and six AOCs as specified in the Order (USEPA 1999). The RFI included consideration of field data collected between the periods of February 24, 1992 and March 4, 1992; January 26, 1999 and February 26, 1999; and March 27, 2000 and March 31, 2000. The rationale and recommendations in this document are based on information detailed in the OU2 RFI report (URS 2001c). Additional samples were collected during the OU3 RFI investigation at the request of the USEPA, in the west parking lot located at approximately 11th and Webster Streets, directly east of the former Economy Products site, a listed Superfund site. Economy Products formulated pesticide products and evidence of pesticide contamination, primarily toxaphene, has been detected in soil and water samples on the Economy Products property.

TABLE 1-1

OU2 RFI SITES

Number	Name
Solid Waste Management Units (SWMUs):	
14	Paint Barrel Pits
18	North and South Open Drum Storage
20	North and South Acetylene Sludge Pits
21	Chemical Spill Area
Areas of Concern (AOCs)	
10	Eighth Street Yard
11	Car Holding Area
12	Car Demolishing Area
13	Grace Street Tank and Pumphouse
14	Grace Street Yard
16	Oil Pipeline



NEBRASKA

QUADRANGLE LOCATION

BASE MAP SOURCE: USGS 7.5 MINUTE SERIES (TOPOGRAPHIC) QUADRANGLE MAP OF OMAHA NORTH, NE.–IA., 1994.

N

2000 1000 0 2000

SCALE IN FEET

February 14, 2006 4:02:40 p.m.
Drawing: T:\16168949\04300\fig01-1.dwg

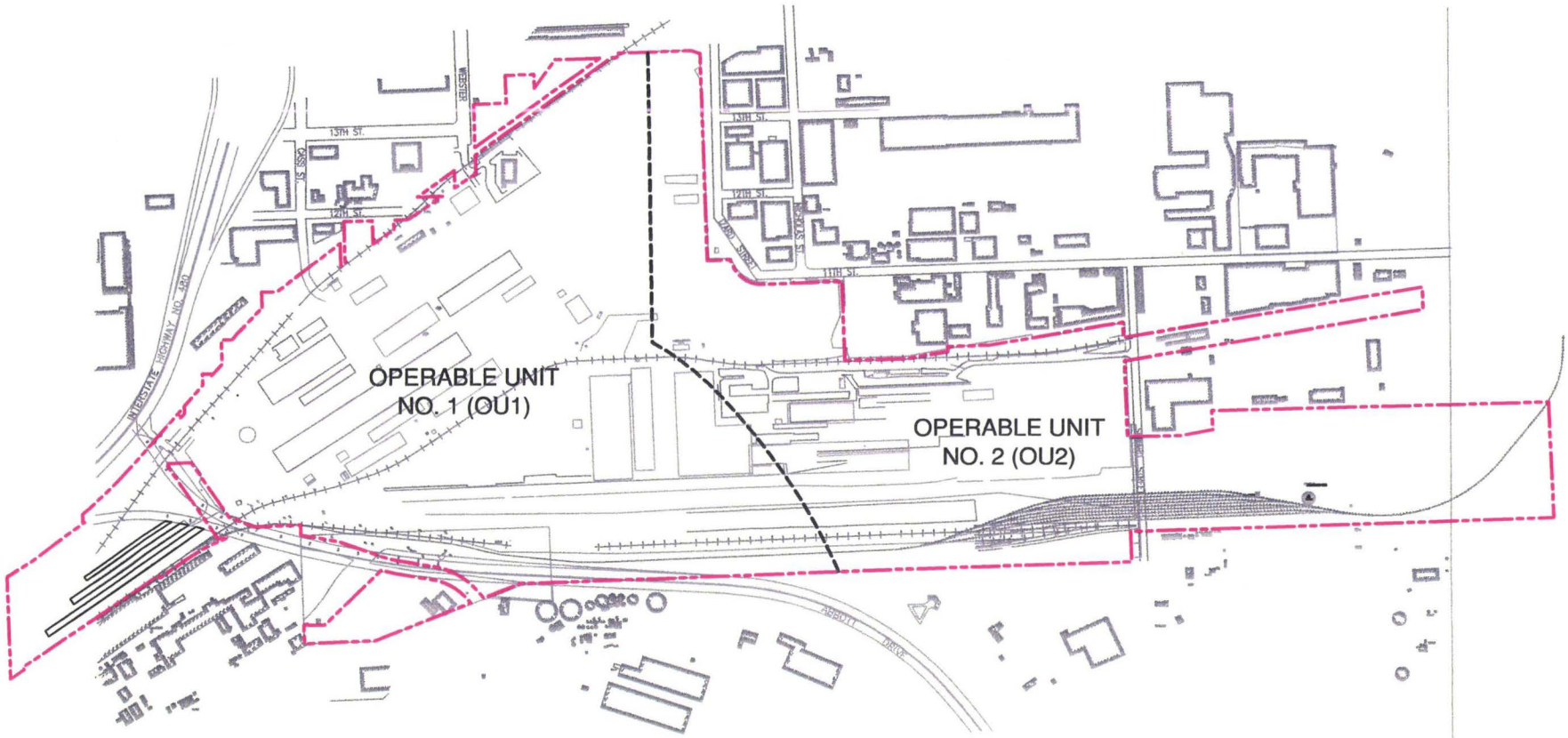
OMAHA SHOPS LOCATION

UNION PACIFIC

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 1-1
CHK'D BY	DATE		



OPERABLE UNIT NO. 3 (OU3) INCLUDES GROUNDWATER UNDERLYING THE ENTIRE OMAHA SHOPS PROPERTY.

LEGEND

UPRR OMAHA SHOPS PROPERTY LINE

OPERABLE UNIT

N

800 400 0 800

SCALE IN FEET

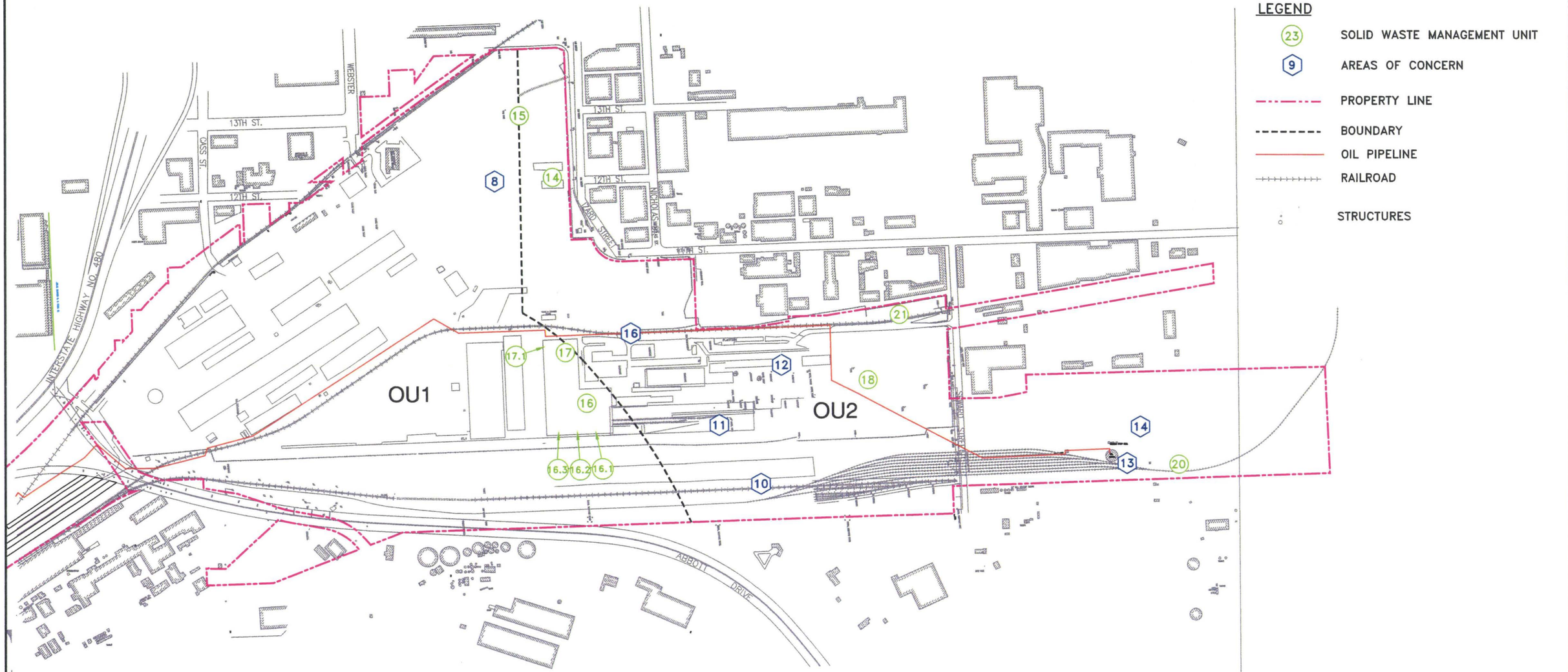
OPERABLE UNITS

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 1-2
CHK'D BY	DATE:		

February 14, 2006 4:03:49 p.m.
Drawing: T:\16168949\04300\fig01-2.dwg



SOLID WASTE MANAGEMENT UNITS

14	PAINT BARREL PITS
15	OLD TRANSFORMER STORAGE AREA*
16	STEEL CAR SHOP*
16.1	STEEL CAR SHOP HAZARDOUS WASTE STORAGE AREA*
16.2	STEEL CAR SHOP NONHAZARDOUS WASTE STORAGE AREA*
16.3	STEEL CAR SHOP SATELLITE ACCUMULATION AREAS*
17	TIN AND PLATING SHOP*
17.1	TIN AND PLATING SHOP PARTS WASHER*
18	NORTH AND SOUTH OPEN DRUM STORAGE
20	NORTH AND SOUTH ACETYLENE SLUDGE PITS
21	CHEMICAL SPILL AREA

*AREA ADDRESSED IN OU1 RFI REPORT

AREAS OF CONCERN

8	EAST AND WEST CAR DISMANTLE AREAS*
10	EIGHTH STREET YARD
11	CAR HOLDING AREA
12	CAR DEMOLISHING AREA
13	GRACE STREET TANK & PUMPHOUSE
14	GRACE STREET YARD
16	OIL PIPELINE

500 250 0 500
SCALE IN FEET

February 14, 2006 4:09:41 p.m.
Drawing: T:\16168949\04300\fig01-3.dwg

OU2 SWMU AND AOC LOCATION MAP

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE	16168949	1-3

2.1 PHYSIOGRAPHY AND SURFACE WATER HYDROLOGY

Only one surface soil type is present at the Omaha Shops (cut and fill land). Cut and fill land (0 to 30 percent slopes) consists of areas that have been leveled or reshaped for industrial tracts. The original soils have been changed to the extent that they are no longer recognizable (Soil Conservation Service [SCS] 1975). The topography of the Omaha Shops is typical of the Missouri River floodplain. The land surface is nearly level (Figure 1-4). Surface drainage is primarily to the east, toward the Missouri River. Surface elevation of the site is approximately 985 feet above mean sea level (msl). The Omaha Shops are about 10 to 15 feet above normal river stage. The major surface water body in the vicinity of the Omaha Shops is the Missouri River.

2.2 GEOLOGY

Regionally, the Omaha area is part of the Great Plains physiographic province. The upland (west of the Omaha Shops) is covered with alluvium deposits of Peoria Loess and younger loess. This is underlain by deposits of glacial till of various ages. Bedrock, underlying the glacial till, crops out at a few locations in steep or broken areas at stream or river borders (SCS 1975).

The Omaha Shops were originally constructed within the Missouri River floodplain. The site was prone to periodic flooding prior to 1952, when the U.S. Army Corps of Engineers built a levee and floodwall along the river, which currently protect the Omaha Shops from flooding.

Shallow unconsolidated deposits at the site are characterized by fill and alluvium. Previous investigation at and near the site indicates that fill ranges in thickness from 1 to 9 feet, with the thickest fill near the river channel. The fill consist of cinders, bricks, glass, metal, and gravel in a matrix of silt (HDR 1990). Alluvial deposits consisting of interbedded clay, silt, sand, and gravel underlie the fill. The alluvial sequence lies above bedrock, which is about 20 to 50 feet below ground surface (bgs) (UPRR 1984). The location of cross section lines and generalized cross sections representing the subsurface conditions at the Omaha Shops are shown in Figures 2-1 and 2-2.

Bedrock is of Pennsylvanian age and consists of alternating beds of limestone and shale. Three different formations are normally encountered in this location; the Wyandotte Limestone, the Lane Shale, and the Iola Limestone. These formations are of the Kansas City Group of the Missouri Series (UPRR 1984).

2.3 HYDROGEOLOGY

Shallow groundwater is encountered at the site at depths ranging from approximately 3 to 15 feet bgs (W-C 1995). Groundwater appears to flow easterly, with an estimated hydraulic gradient in the direction of flow estimated at 0.01 feet per foot (HDR 1990). The alluvial sediments are expected to have a low hydraulic conductivity with a range of 0.3 to 0.003 feet per day. Hydraulic recharge is likely from surface infiltration due to the porous characteristics of the surface fill materials (UPRR 1984). However, the southern end of the property has had

compacted fill and pavements added as part of the City of Omaha's public-use building development, which has reduced hydraulic recharge from surface infiltration.

2.4 DISTRIBUTION OF CONTAMINATION

Volatile organic compounds, semivolatile organic compounds, pesticides/PCBs, petroleum hydrocarbons, metals, and asbestos were detected in surface and subsurface soils at OU2. The chemical data generally indicate a random vertical and horizontal distribution of potential chemicals of concern in surface and subsurface soils at OU2 (Figure 2-3 through 2-10).

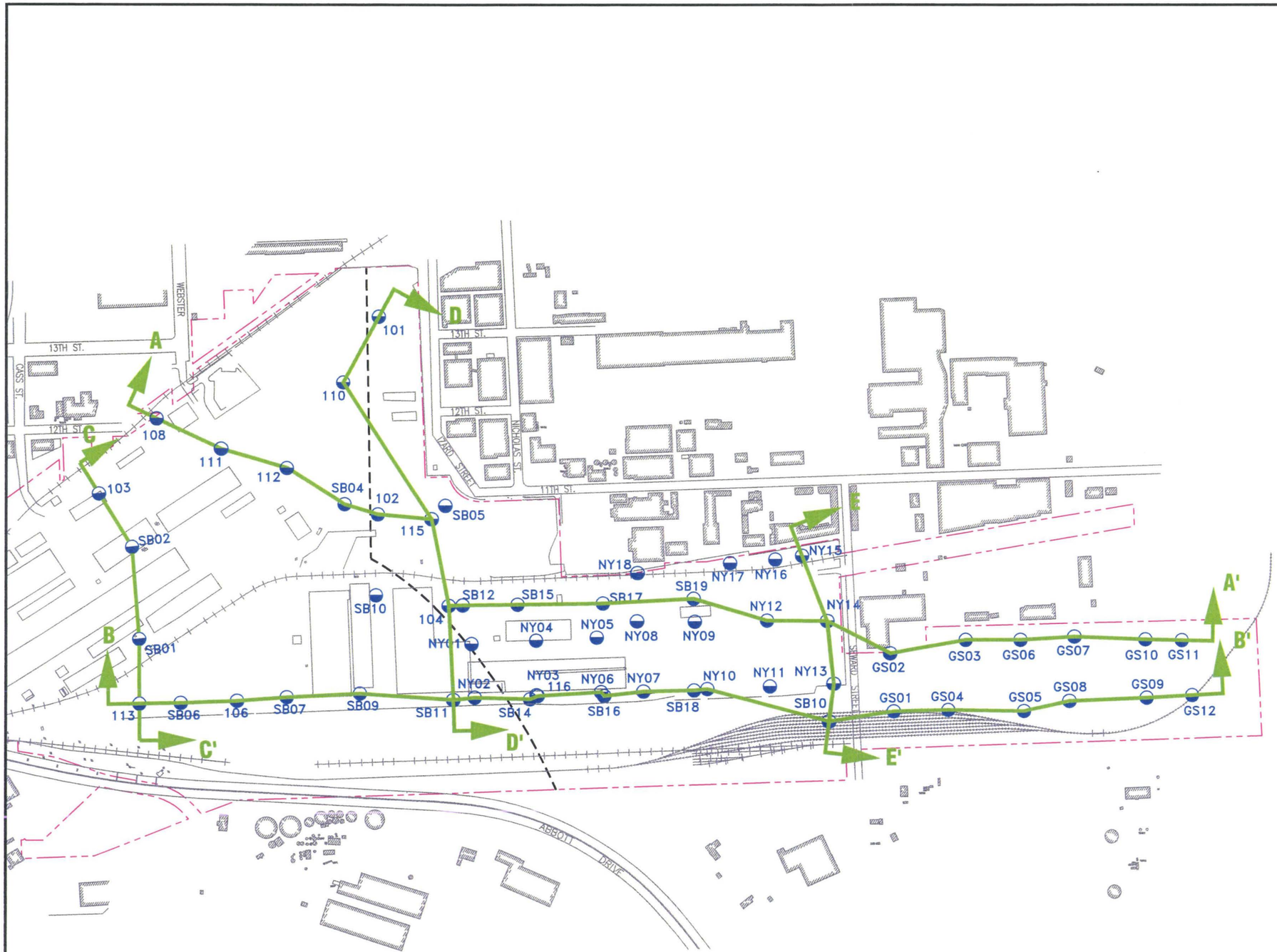
2.5 HUMAN HEALTH RISKS

The health risk assessment was completed in two parts, OU2 and as a "hot spot," the acetylene sludge pits. Risks to human health were assessed using current measured contaminant concentrations for the following scenarios: occupational workers, construction workers, and recreational users/trespassers. Estimated excess cancer risks for occupational workers, construction workers, and recreational users/trespassers were below the upper end of the United States Environmental Protection Agency target risk range of 1×10^{-6} to 1×10^{-4}. No adverse health risks were estimated for OU2 exposure scenarios. Estimated excess cancer risks for occupational workers, construction workers, and recreational users/trespassers at the acetylene sludge pits were below the target risk range, but the target hazard index of 1 was exceeded for the construction worker (1.65).

2.6 ACTION LEVELS

An action level was estimated for lead in soil at OU2. The USEPA Technical Review Workshop adult lead model was used to derive an action level of 1,218 mg/kg for lead in soil at the Omaha Shops, assuming a commercial worker scenario. Analytical data for OU2 was arriving concurrently with interim measure and corrective measure implementation work being completed in OU1. As analytical data arrived indicating lead concentrations above the 1,218 mg/kg action level in OU1, soil was excavated from the OU2 sampling location and placed with the OU1 soil in the Abbott Drive/Cuming Street embankment. Confirmation samples were collected and the excavation backfilled when the lead concentration was below 1,218 mg/kg.

Exposure to tetrachloroethene was the primary driver of the human health risks for construction workers at the Acetylene Sludge Pits and an action level of 2,509 mg/kg was calculated for tetrachloroethene. An Interim Measure was completed in 2 parts at the Acetylene Sludge Pits, necessitated by the City of Omaha's acquisition of OU1 for development of a public-use facility. A new classification yard was constructed within OU2 requiring the removal of a small portion of the North and South Acetylene Sludge pits to make room for new tracks. These initial removal activities took place in the Summer of 2000. The remaining portion of the North and South Acetylene Sludge Pits were excavated in the Spring of 2002. Additional information concerning the Interim Measure can be found in Section 5.0 and the Acetylene Sludge Pits Interim Measure Completion Report (URS 2002).



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION
- A A' CROSS SECTION

500 250 0 500

SCALE IN FEET

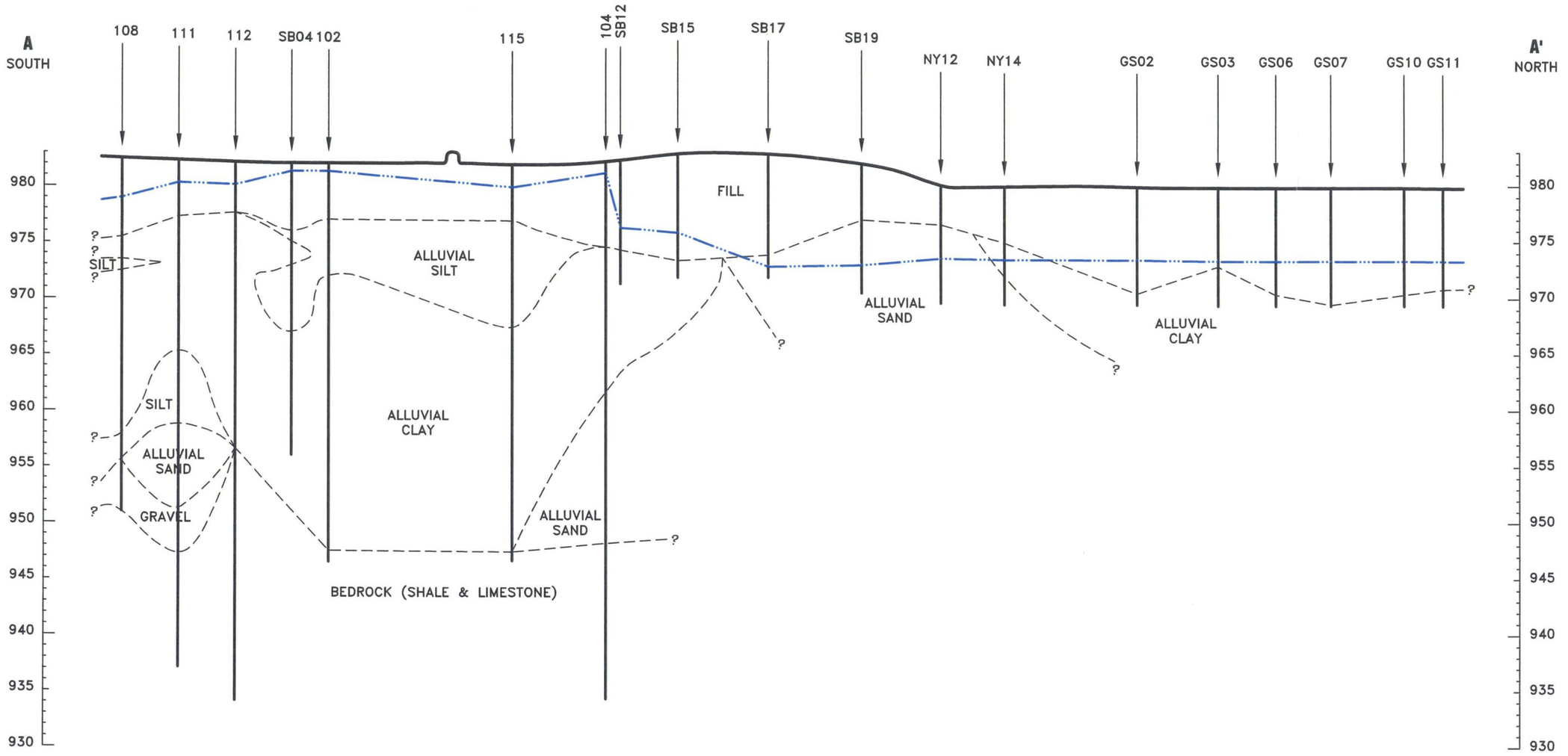
February 14, 2006 4:10:53 p.m.
Drawing: T:\16168949\04300\fig02-1.dwg

GEOLOGIC CROSS SECTION LINES

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-1
CHK'D BY	DATE		



—·····— GROUNDWATER LEVEL MEASURED MARCH 8, 1996

NOTE: THIS FIGURE REPRESENTS A CONCEPTUAL GEOLOGIC MODEL. THE ACTUAL SUBSURFACE CONDITIONS MAY VARY FROM THE SHOWN INTERPRETATIONS. SEE BORING LOGS FOR DETAILED DESCRIPTIONS.

10 5 0 10
VERTICAL SCALE IN FEET

500 0 500
HORIZONTAL SCALE IN FEET

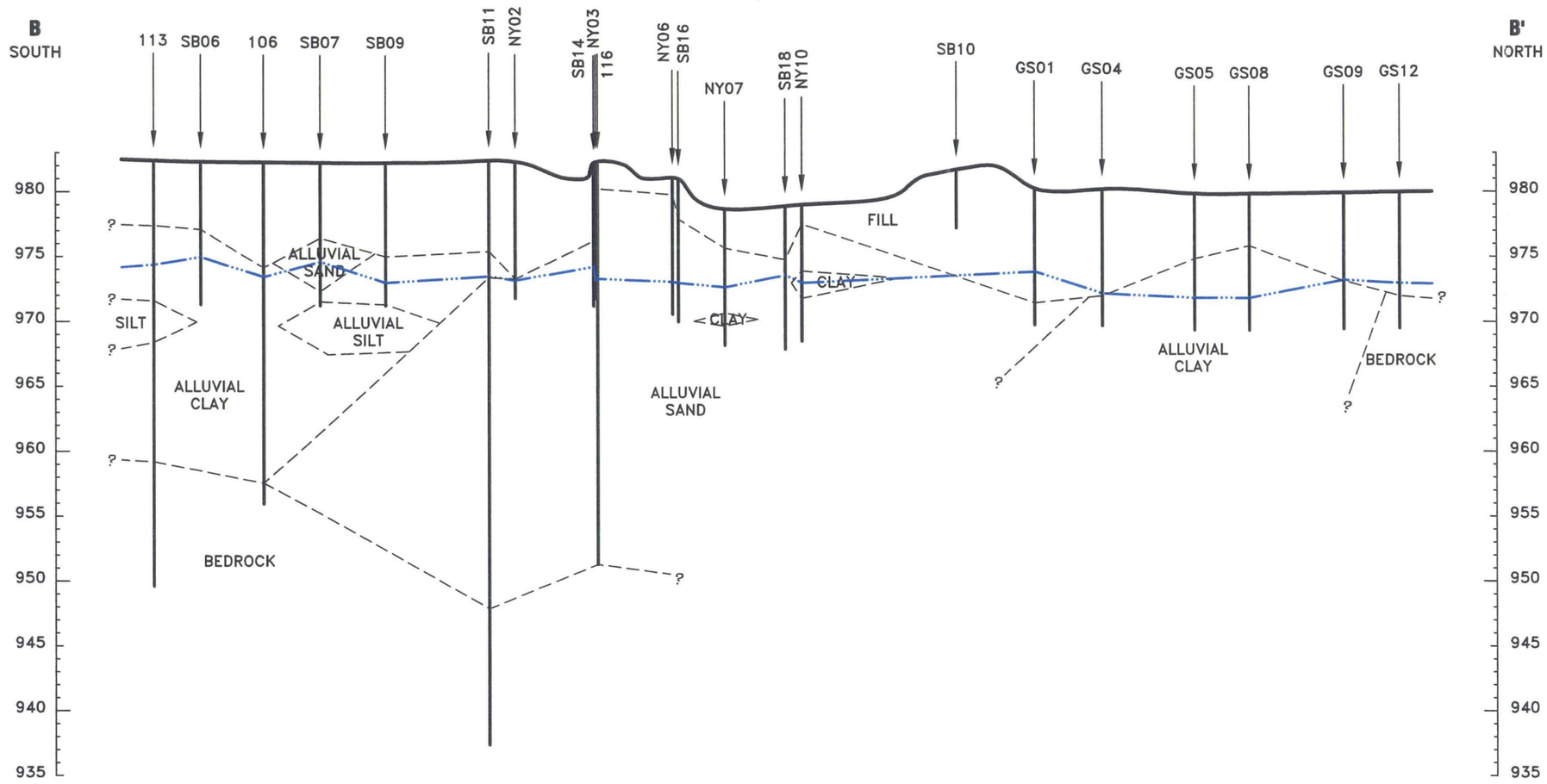
February 14, 2006 4:20:14 p.m.
Drawing: T:\16168949\04300\fig02-2.dwg
A-A'

GEOLOGIC CROSS SECTION A–A'

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-2a
CHK'D BY:	DATE:		



GROUNDWATER LEVEL MEASURED MARCH 8, 1996

NOTE: THIS FIGURE REPRESENTS A CONCEPTUAL GEOLOGIC MODEL. THE ACTUAL SUBSURFACE CONDITIONS MAY VARY FROM THE SHOWN INTERPRETATIONS. SEE BORING LOGS FOR DETAILED DESCRIPTIONS.

10 5 0 10
VERTICAL SCALE IN FEET

500 0 500
HORIZONTAL SCALE IN FEET

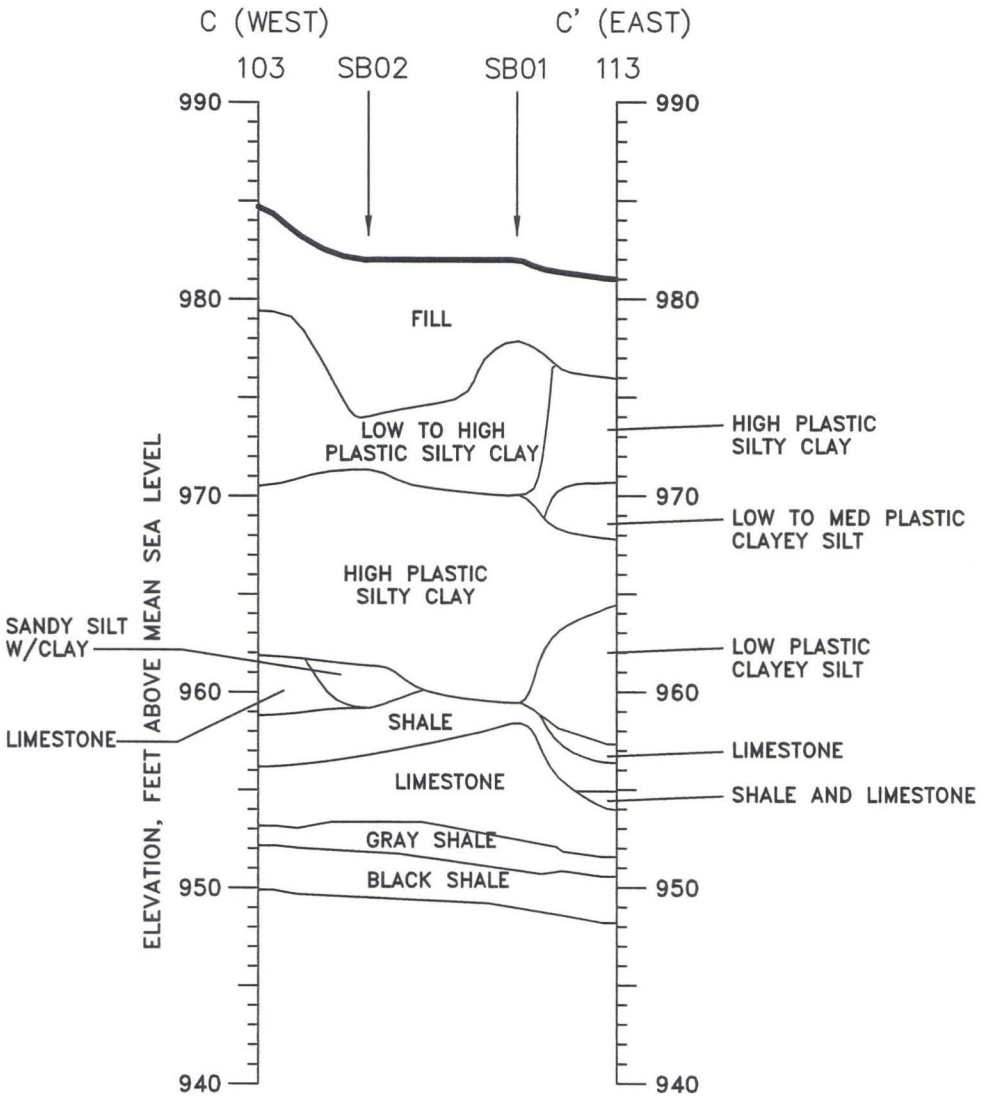
February 14, 2006 4:20:20 p.m.
Drawing: T:\16168949\04300\fig02-2.dwg
B-B'

GEOLOGIC CROSS SECTION B-B'

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-2b
CHK'D BY:	DATE:		



10 5 0 10
VERTICAL SCALE IN FEET

500 0 500
HORIZONTAL SCALE IN FEET

NOTE: THIS FIGURE REPRESENTS A CONCEPTUAL GEOLOGIC MODEL. THE ACTUAL SUBSURFACE CONDITIONS MAY VARY FROM THE SHOWN INTERPRETATIONS. SEE BORING LOGS FOR DETAILED DESCRIPTIONS.

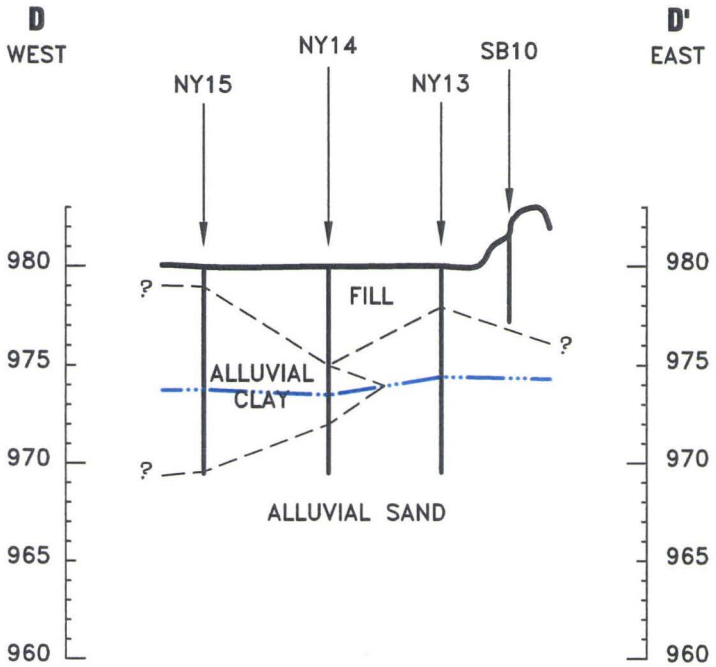
February 14, 2006 4:21:32 p.m.
Drawing: T:\16168949\04300\fig02-2c.dwg

GEOLOGIC CROSS SECTION C–C'

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-2c
CHK'D BY:	DATE:		



10 5 0 10

VERTICAL SCALE IN FEET

500 0 500

HORIZONTAL SCALE IN FEET

——·····—— GROUNDWATER LEVEL MEASURED MARCH 8, 1996

NOTE: THIS FIGURE REPRESENTS A CONCEPTUAL GEOLOGIC MODEL. THE ACTUAL SUBSURFACE CONDITIONS MAY VARY FROM THE SHOWN INTERPRETATIONS. SEE BORING LOGS FOR DETAILED DESCRIPTIONS.

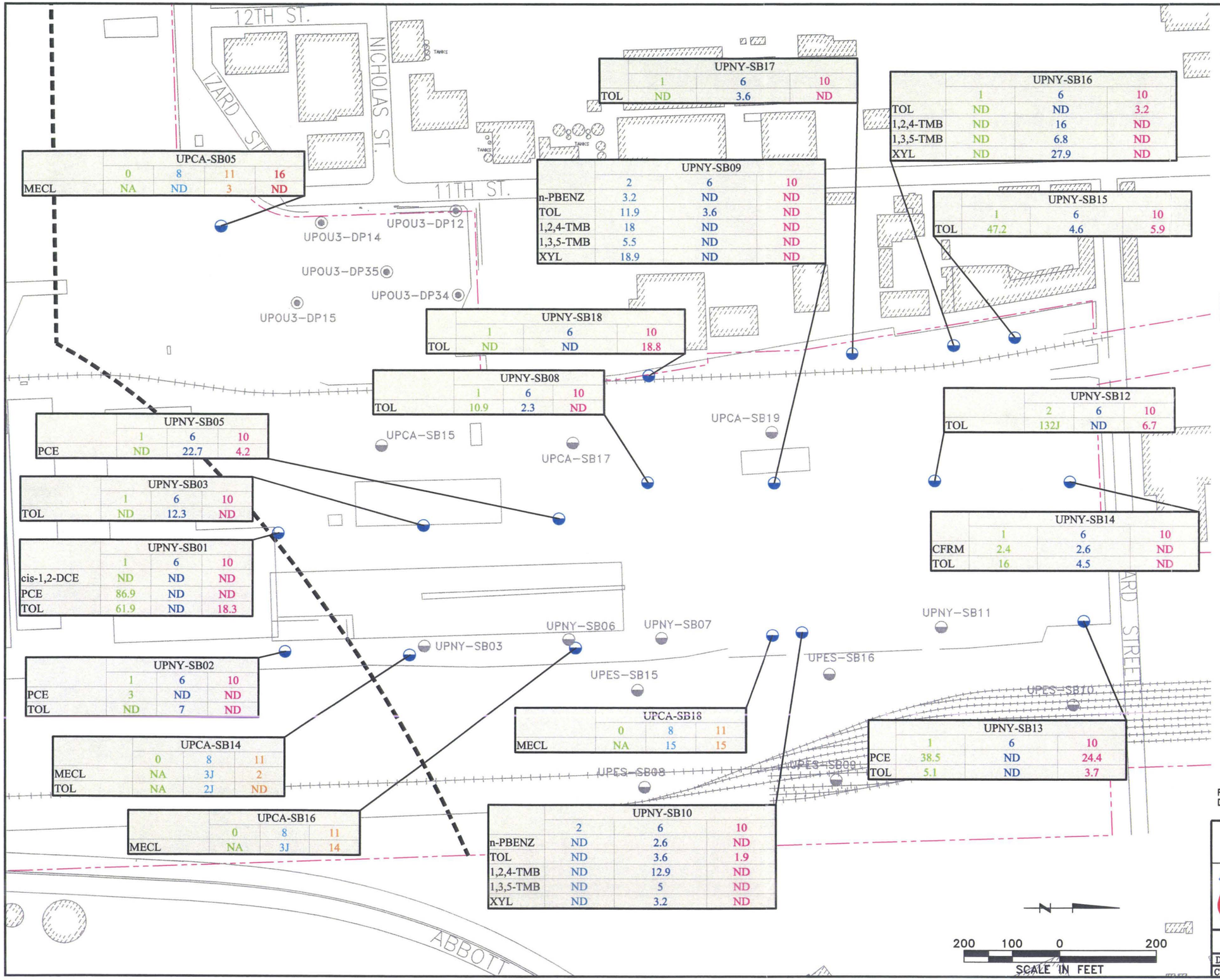
GEOLOGIC CROSS SECTION D–D'

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/03/06	PROJECT NO. 16168949	FIG. NO. 2–2d
CHK'D BY:	DATE:		

February 14, 2006 4:24:18 p.m.
Drawing: T:\16168949\04300\fig02-2.dwg
E-E'



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION
- DIRECT PUSH LOCATION

	UPCA–SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D.

SITE I.D.
SOIL BORING I.D.
SAMPLE DEPTH INTERVAL
CONCENTRATION IN µg/kg

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
3 – 4' BELOW GROUND SURFACE
4.5 – 6' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE
9.5 – 11' BELOW GROUND SURFACE
14.5 – 16' BELOW GROUND SURFACE

1,4–DCB –1,4–Dichlorobenzene
1,3,5–TMB –1,3,5–Trimethylbenzene
BENZ –Benzene
cis–1,2–DCE –cis–1,2,Dichloroethene
CBENZ –Chlorobenzene
CFRM –Chloroform
1,1–DCE –Dichloroethene
MECL –Methylene chloride
n–BBENZ –n–Butylbenzene
n–PBENZ –n–Propylbenzene
PCA –1,1,1,2–Tetrachloroethane
PCE –Tetrachloroethene
1,2,4–TMB –1,2,4–Trimethylbenzene
TOL –Toluene
trans–1,2–DCE –trans–1,2,Dichloroethene
TCE –Trichloroethene
XYL –Xylenes, Total
VC –Vinyl Chloride

ND – non–detect
NA – not analyzed

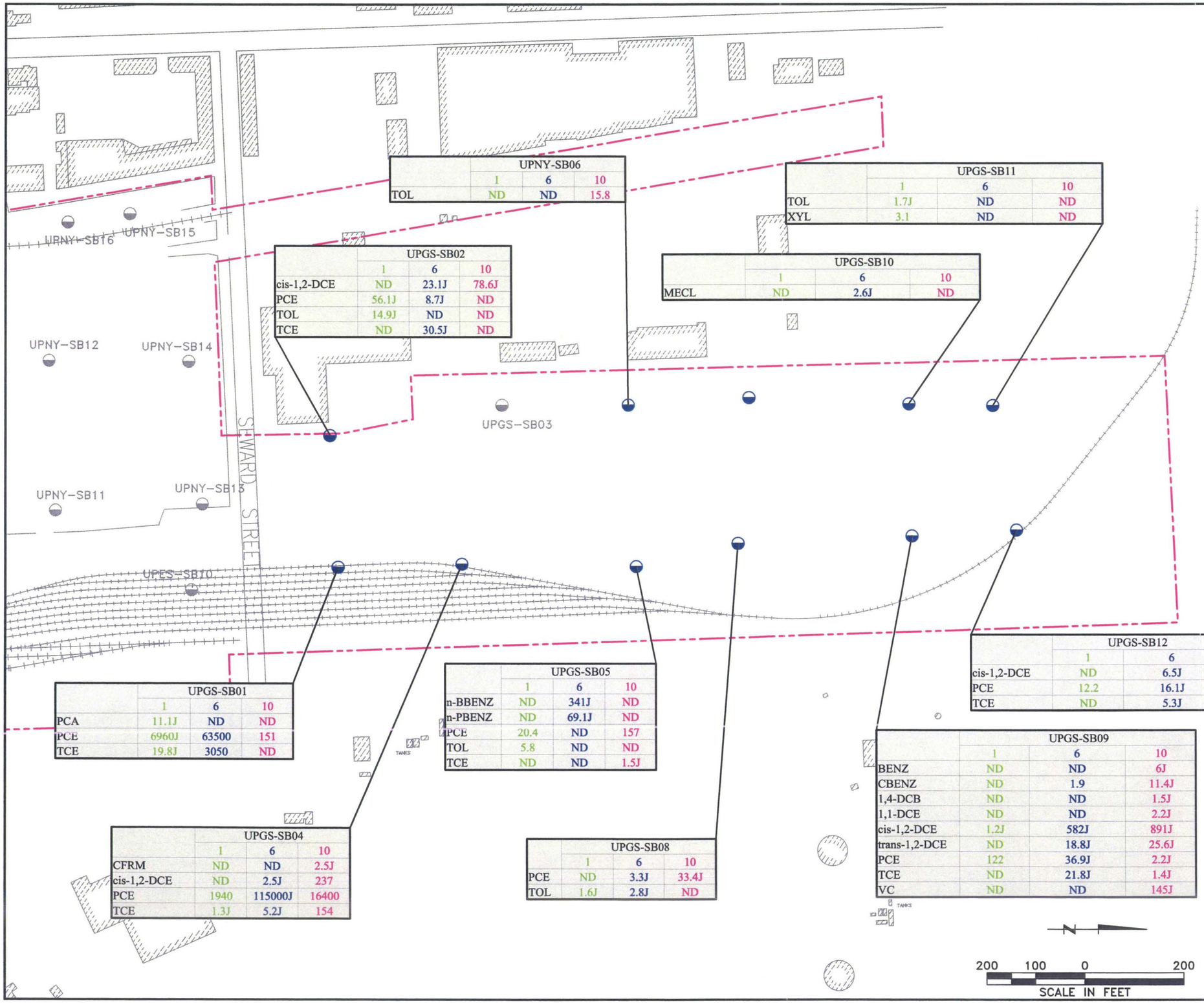
February 16, 2006 10:03:35 a.m.
Drawing: T:\16168949\04300\fig02–3a.dwg

VOC CONCENTRATIONS NORTH YARD SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 2–3a
CHK'D BY	DATE		



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION

SITE I.D. / SOIL BORING I.D.	UPCA-SB02	
SAMPLE DEPTH INTERVAL	0	16
DNB	4.1	2.6
FANT	1.9	ND

CONCENTRATION IN µg/kg

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
4.5 – 6' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE
9.5 – 11' BELOW GROUND SURFACE
14.5 – 16' BELOW GROUND SURFACE

1,4-DCB –1,4–Dichlorobenzene
1,3,5-TMB –1,3,5–Trimethylbenzene
BENZ –Benzene
cis–1,2–DCE –cis–1,2,Dichloroethene
CBENZ –Chlorobenzene
CFRM –Chloroform
1,1–DCE –Dichloroethene
MECL –Methylene chloride
n–BBENZ –n–Butylbenzene
n–PBENZ –n–Propylbenzene
PCA –1,1,1,2–Tetrachloroethane
PCE –Tetrachloroethene
1,2,4–TMB –1,2,4–Trimethylbenzene
TOL –Toluene
trans–1,2–DCE –trans–1,2,Dichloroethene
TCE –Trichloroethene
XYL –Xylenes, Total
VC –Vinyl Chloride

ND – non–detect
NA – not analyzed

February 14, 2006 4:28:47 p.m.
Drawing: T:\16168949\04300\fig02-3b.dwg

VOC CONCENTRATIONS GRACE STREET SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-3b
CHK'D BY	DATE		

UPCA-SB05				
	0	8	11	16
CHR	1	ND	ND	ND
FANT	2.3	ND	ND	ND
PHEN	1.7	ND	ND	ND
PYR	2.1	ND	ND	ND

UPCA-SB15			
	0	8	11
ANT	ND	1	ND
BENZA	5.2	1.6	ND
BENZP	5.3	1.3	ND
BENBF	5.7	ND	ND
BENGHIP	4.5	ND	ND
BENKF	4.6	ND	ND
CHR	5.3	1.3	ND
FANT	8.5	3.2	ND
PHEN	7.3	3	ND
PYR	9.9	3	ND
NAP	2.2	ND	ND
ICDP	4	ND	ND

UPCA-SB19		
	0	11
FANT	1.2	ND

12TH ST.

11TH ST.

GRACE STREET

TANKS

UPOU3-DP12

UPOU3-DP14

UPOU3-DP35

UPOU3-DP34

UPOU3-DP15

UPNY-SB18

UPNY-SB17

UPNY-SB16

UPNY-SB15

UPCA-SB17

UPNY-SB12

UPNY-SB14

UPNY-SB01

UPNY-SB04

UPNY-SB05

UPNY-SB08

UPNY-SB09

UPNY-SB02

UPNY-SB03

UPNY-SB06

UPNY-SB07

UPCA-SB18

UPNY-SB10

UPNY-SB11

UPNY-SB13

UPCA-SB14

UPCA-SB16

UPES-SB16

UPES-SB15

UPES-SB10

UPES-SB08

UPES-SB09

SEWARD STREET

ABBOTT

LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION
- DIRECT PUSH LOCATION

SITE I.D. / SOIL BORING I.D.	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SAMPLE DEPTH INTERVAL

CONCENTRATION IN µg/g

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
3 – 4' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
9.5 – 11' BELOW GROUND SURFACE
14.5 – 16' BELOW GROUND SURFACE

ANT – Anthracene
BENZA – Benzo(a)anthracene
BENZP – Benzo(a)pyrene
BENBF – Benzo(b)fluoranthene
BENKF – Benzo(k)fluoranthene
CHR – Chrysene
FANT – Fluoranthene
NAP – Naphthalene
PHEN – Phenanthrene
PYR – Pyrene
BENGHIP – Benzo(ghi)perylene
ICDP – Indeno(1,2,3–cd)pyrene

ND – non–detect

N

200 100 0 200

SCALE IN FEET

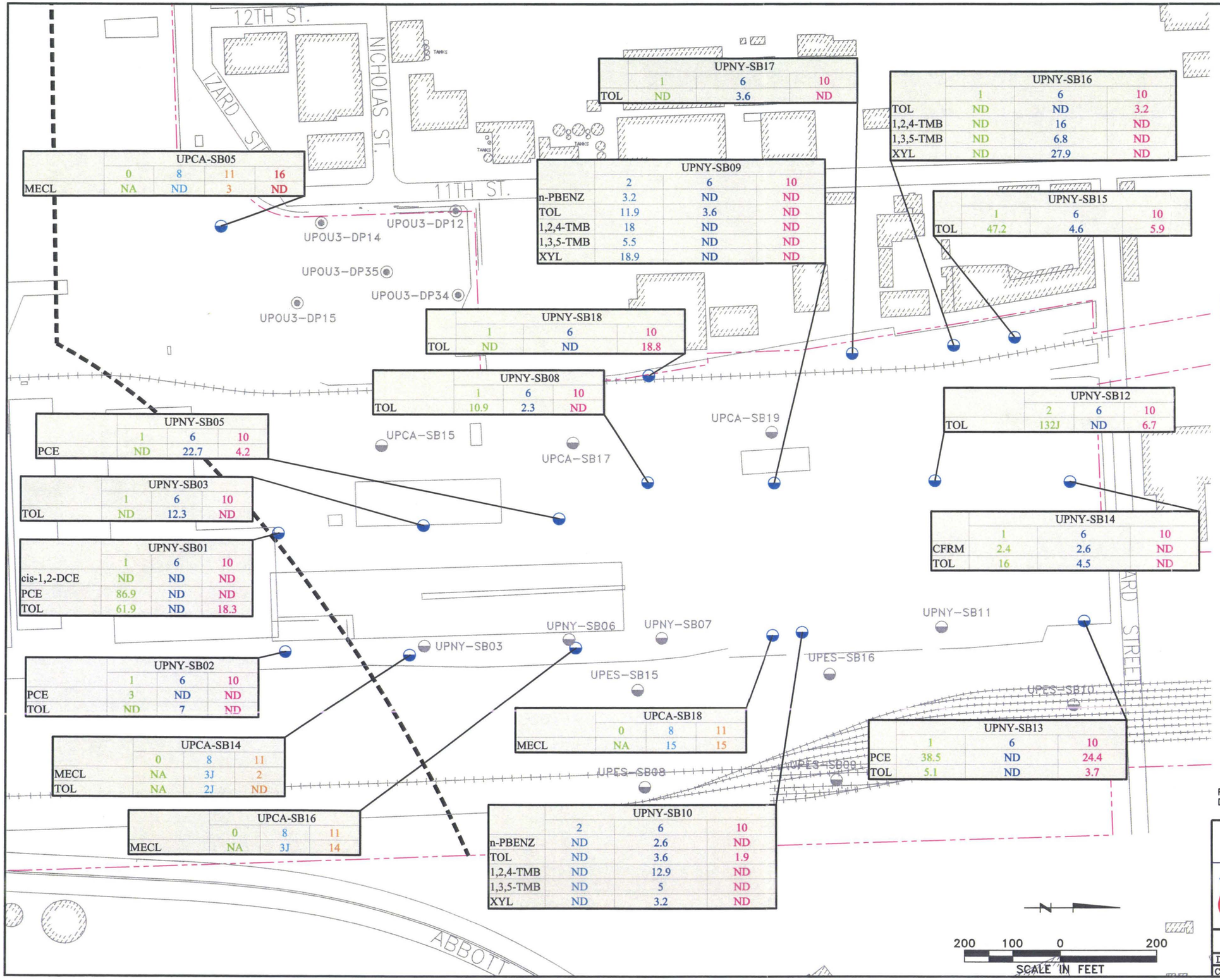
February 16, 2006 10:04:01 a.m.
Drawing: T:\16168949\04300\fig02-4.dwg

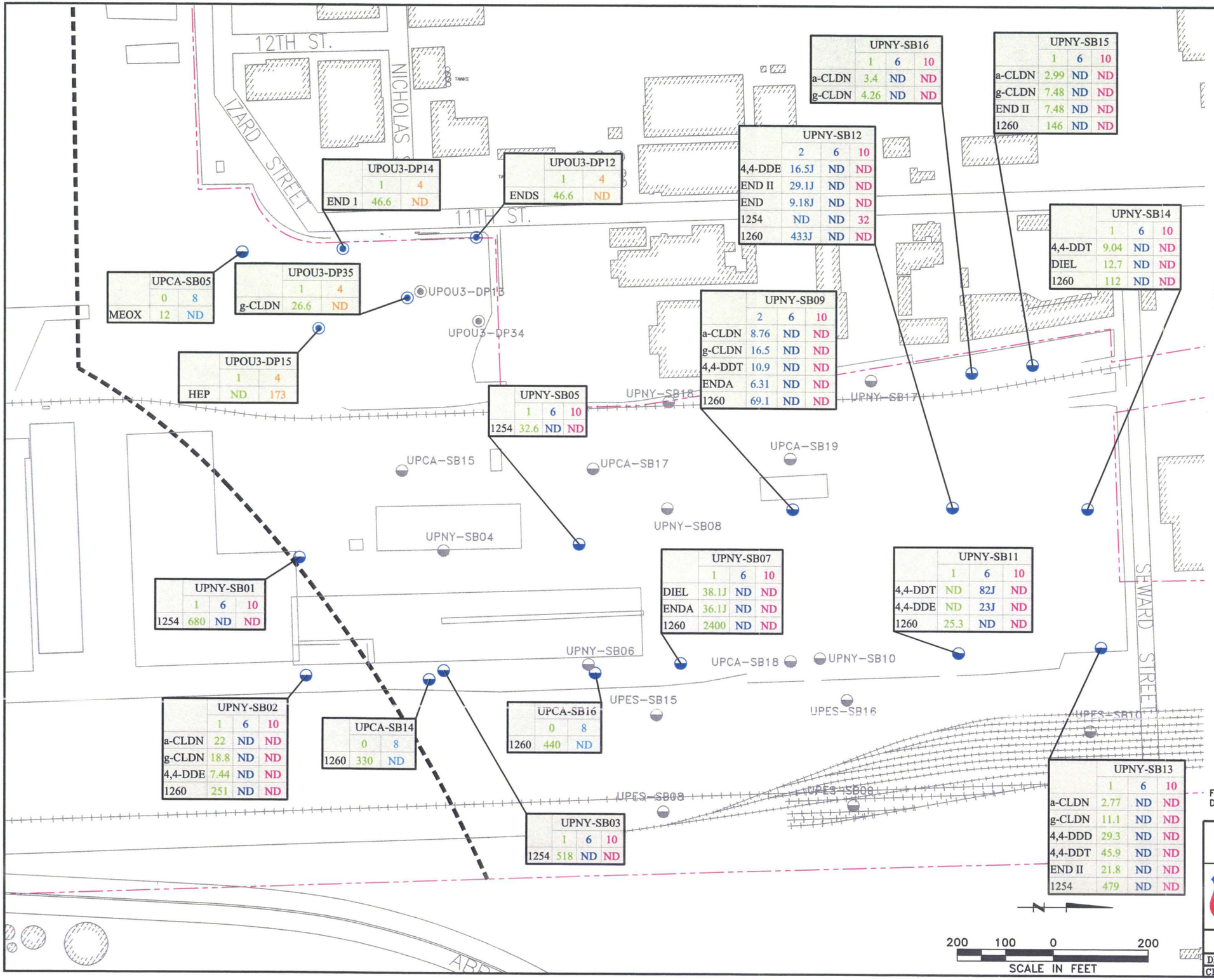
SVOC CONCENTRATIONS NORTH YARD SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-4
CHK'D BY	DATE		


12TH ST.
NICHOLAS ST.
IZARD ST.
11TH ST.
ABBOTT
IZARD STREET
UPCA-SB05
0 8 11 16
MECL NA ND 3 ND
UPNY-SB17
1 6 10
TOL ND 3.6 ND
UPNY-SB16
1 6 10
TOL ND ND 3.2
1,2,4-TMB ND 16 ND
1,3,5-TMB ND 6.8 ND
XYL ND 27.9 ND
UPNY-SB09
2 6 10
n-PBENZ 3.2 ND ND
TOL 11.9 3.6 ND
1,2,4-TMB 18 ND ND
1,3,5-TMB 5.5 ND ND
XYL 18.9 ND ND
UPNY-SB15
1 6 10
TOL 47.2 4.6 5.9
UPOU3-DP14
UPOU3-DP12
UPOU3-DP35
UPOU3-DP34
UPOU3-DP15
UPNY-SB18
1 6 10
TOL ND ND 18.8
UPNY-SB08
1 6 10
TOL 10.9 2.3 ND
UPNY-SB05
1 6 10
PCE ND 22.7 4.2
UPCA-SB15
UPCA-SB17
UPCA-SB19
UPNY-SB12
2 6 10
TOL 132J ND 6.7
UPNY-SB03
1 6 10
TOL ND 12.3 ND
UPNY-SB14
1 6 10
CFRM 2.4 2.6 ND
TOL 16 4.5 ND
UPNY-SB01
1 6 10
cis-1,2-DCE ND ND ND
PCE 86.9 ND ND
TOL 61.9 ND 18.3
UPNY-SB06
UPNY-SB07
UPNY-SB03
UPNY-SB11
UPES-SB16
UPES-SB15
UPES-SB10
UPNY-SB02
1 6 10
PCE 3 ND ND
TOL ND 7 ND
UPCA-SB18
0 8 11
MECL NA 15 15
UPNY-SB13
1 6 10
PCE 38.5 ND 24.4
TOL 5.1 ND 3.7
UPES-SB09
UPES-SB08
UPCA-SB14
0 8 11
MECL NA 3J 2
TOL NA 2J ND
UPCA-SB16
0 8 11
MECL NA 3J 14
UPNY-SB10
2 6 10
n-PBENZ ND 2.6 ND
TOL ND 3.6 1.9
1,2,4-TMB ND 12.9 ND
1,3,5-TMB ND 5 ND
XYL ND 3.2 ND
200 100 0 200
SCALE IN FEET
LEGEND
PROPERTY LINE
OU1/OU2 LINE
BUILDING SLAB
STRUCTURES
SOIL BORING LOCATION
DIRECT PUSH LOCATION
SITE I.D.
SOIL BORING I.D.
UPCA-SB02
0 16
DNB 4.1 2.6
FANT 1.9 ND
SAMPLE DEPTH INTERVAL
CONCENTRATION IN µg/kg
SITE I.D.
CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET
0 – 1' SURFACE SOIL
3 – 4' BELOW GROUND SURFACE
4.5 – 6' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE
9.5 – 11' BELOW GROUND SURFACE
14.5 – 16' BELOW GROUND SURFACE
1,4-DCB –1,4–Dichlorobenzene
1,3,5-TMB –1,3,5–Trimethylbenzene
BENZ –Benzene
cis-1,2-DCE –cis–1,2,Dichloroethene
CBENZ –Chlorobenzene
CFRM –Chloroform
1,1-DCE –Dichloroethene
MECL –Methylene chloride
n-BBENZ –n–Butylbenzene
n-PBENZ –n–Propylbenzene
PCA –1,1,1,2–Tetrachloroethane
PCE –Tetrachloroethene
1,2,4-TMB –1,2,4–Trimethylbenzene
TOL –Toluene
trans-1,2-DCE –trans–1,2,Dichloroethene
TCE –Trichloroethene
XYL –Xylenes, Total
VC –Vinyl Chloride
ND – non-detect
NA – not analyzed
February 16, 2006 10:03:35 a.m.
Drawing: T:\16168949\04300\fig02-3a.dwg
VOC CONCENTRATIONS
NORTH YARD SOIL
UNION PACIFIC
OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY
URS
DRN BY DPG
CHK'D BY
DATE 01/03/06
DATE
PROJECT NO. 16168949
FIG. NO. 2–3a



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- DIRECT PUSH LOCATION
- SOIL BORING LOCATION

	SITE I.D.	SOIL BORING I.D.
	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SAMPLE DEPTH INTERVAL

CONCENTRATION IN $\mu g/kg$

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
3 – 4' BELOW GROUND SURFACE
4.5 – 6' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE

4,4-DDD –4,4'-DDD
4,4-DDE –4,4'-DDE
4,4-DDT –4,4'-DDT
a-CLDN –alpha Chlordane
1254 –Aroclor 1254
1260 –Aroclor 1260
DIEL –Dieldrin
ENDS –Endosulfan Sulfate
END I –Endosulfan I
END II –Endosulfan II
END –Endrin
ENDA –Endrin Aldehyde
g-CLDN –gamma-Chlordane
MEOX –Methoxychlor
HEP –Heptachlor
ND – non-detect

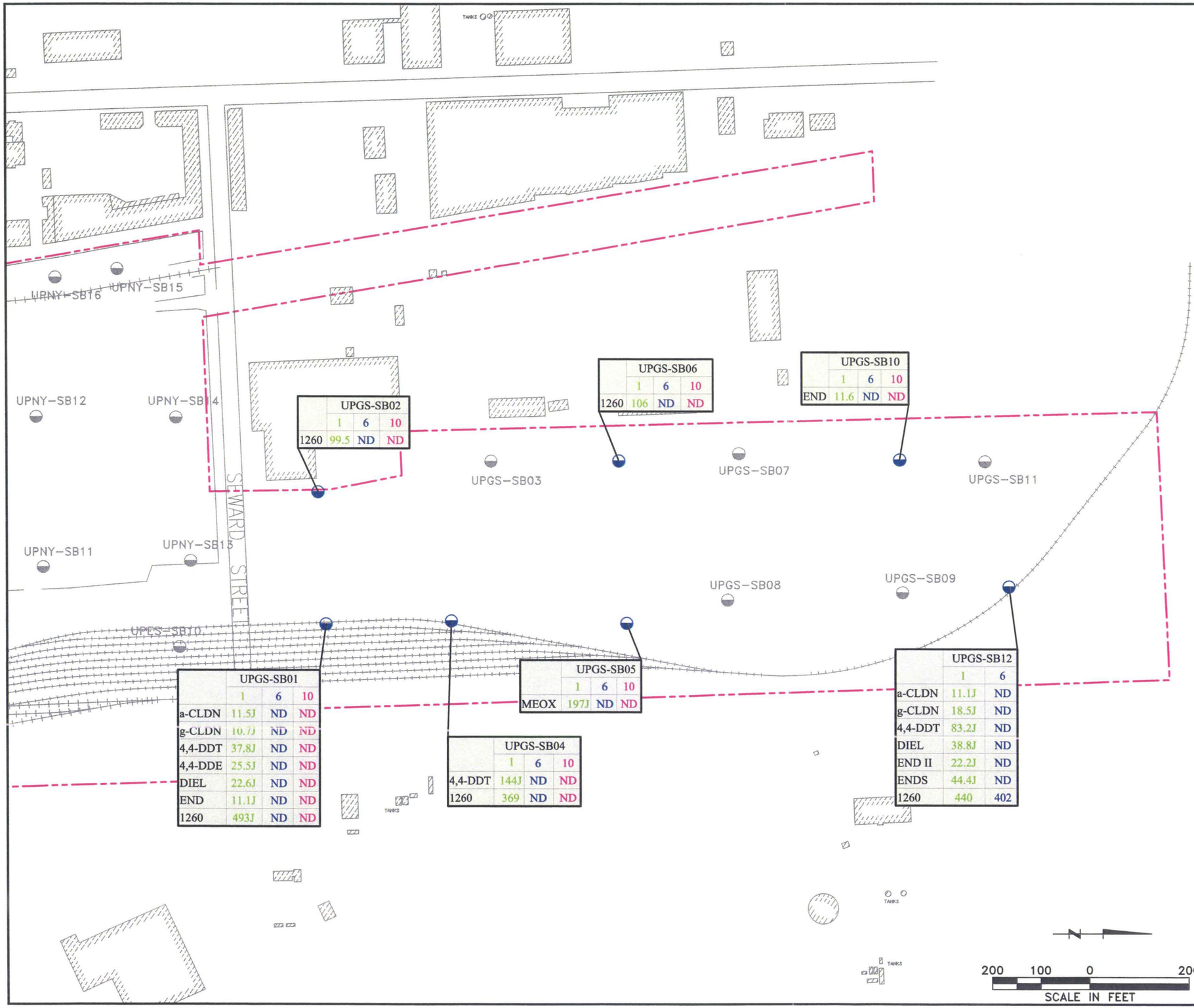
February 16, 2006 10:02:15 a.m.
Drawing: T:\16168949\04300\fig02-5a.dwg

PESTICIDE/PCB CONCENTRATIONS NORTH YARD SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY	DPG	DATE	01/03/06	PROJECT NO.	FIG. NO.
CHK'D BY		DATE		16168949	2-5a



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D. = SITE I.D. + SOIL BORING I.D.

SAMPLE DEPTH INTERVAL

CONCENTRATION IN $\mu g/kg$

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
4.5 – 6' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE

4,4-DDD –4,4'-DDD
4,4-DDE –4,4'-DDE
4,4-DDT –4,4'-DDT
a-CLDN –alpha Chlordane
1254 –Aroclor 1254
1260 –Aroclor 1260
DIEL –Dieldrin
ENDS –Endosulfan Sulfate
END II –Endosulfan II
END –Endrin
ENDA –Endrin Aldehyde
g-CLDN –gamma-Chlordane
MEOX –Methoxychlor

ND – non-detect

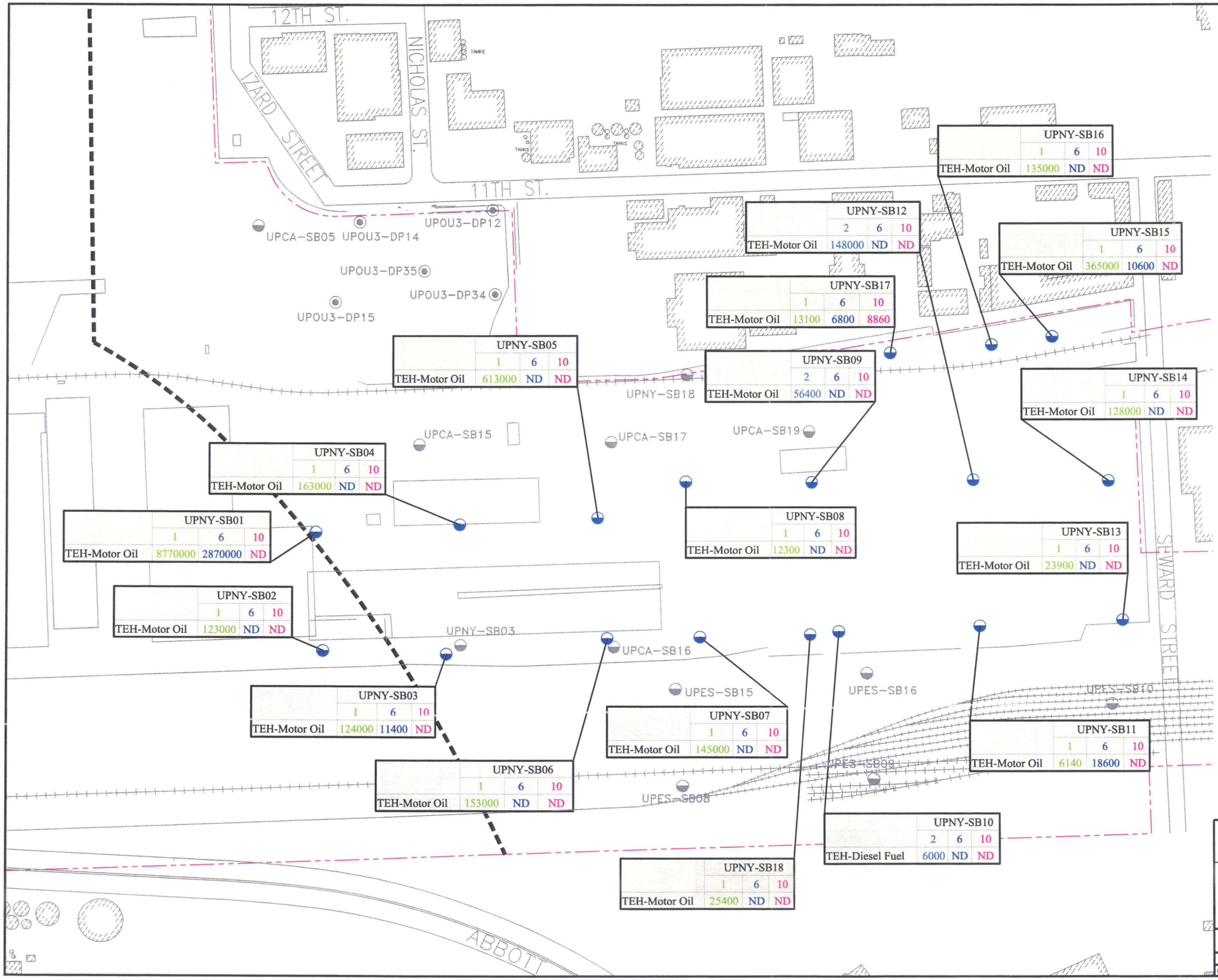
February 15, 2006 2:07:44 p.m.
Drawing: T:\16168949\04300\fig02-5b.dwg

PESTICIDE/PCB CONCENTRATIONS GRACE STREET SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE	16168949	2-5b



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION
- DIRECT PUSH LOCATION

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D.
SOIL BORING I.D.
SAMPLE DEPTH INTERVAL
CONCENTRATION IN µg/kg

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
3 – 4' BELOW GROUND SURFACE
4.5 – 6' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE

TEH
ND – TOTAL EXTRACTABLE HYDROCARBONS
– NON-DETECT

N

200 100 0 200
SCALE IN FEET

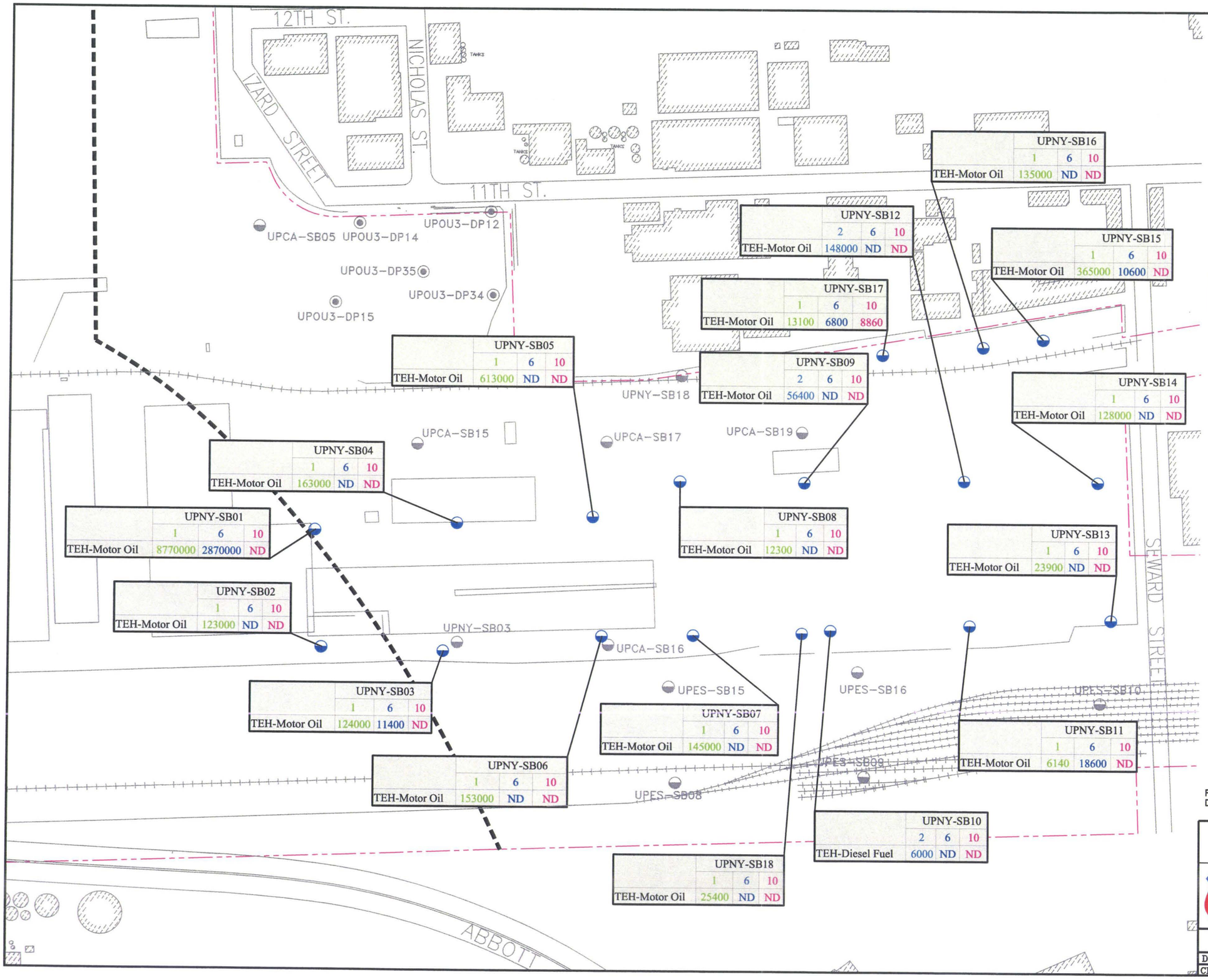
February 16, 2006 10:07:28 a.m.
Drawing: T:\16168949\04300\fig02-6a.dwg

TEH CONCENTRATIONS NORTH YARD SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-6a
CHK'D BY	DATE		



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION
- DIRECT PUSH LOCATION

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D.
SOIL BORING I.D.
SAMPLE DEPTH INTERVAL
CONCENTRATION IN $\mu g/kg$

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
3 – 4' BELOW GROUND SURFACE
4.5 – 6' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE

TEH
ND – TOTAL EXTRACTABLE HYDROCARBONS
– NON-DETECT

N

200 100 0 200
SCALE IN FEET

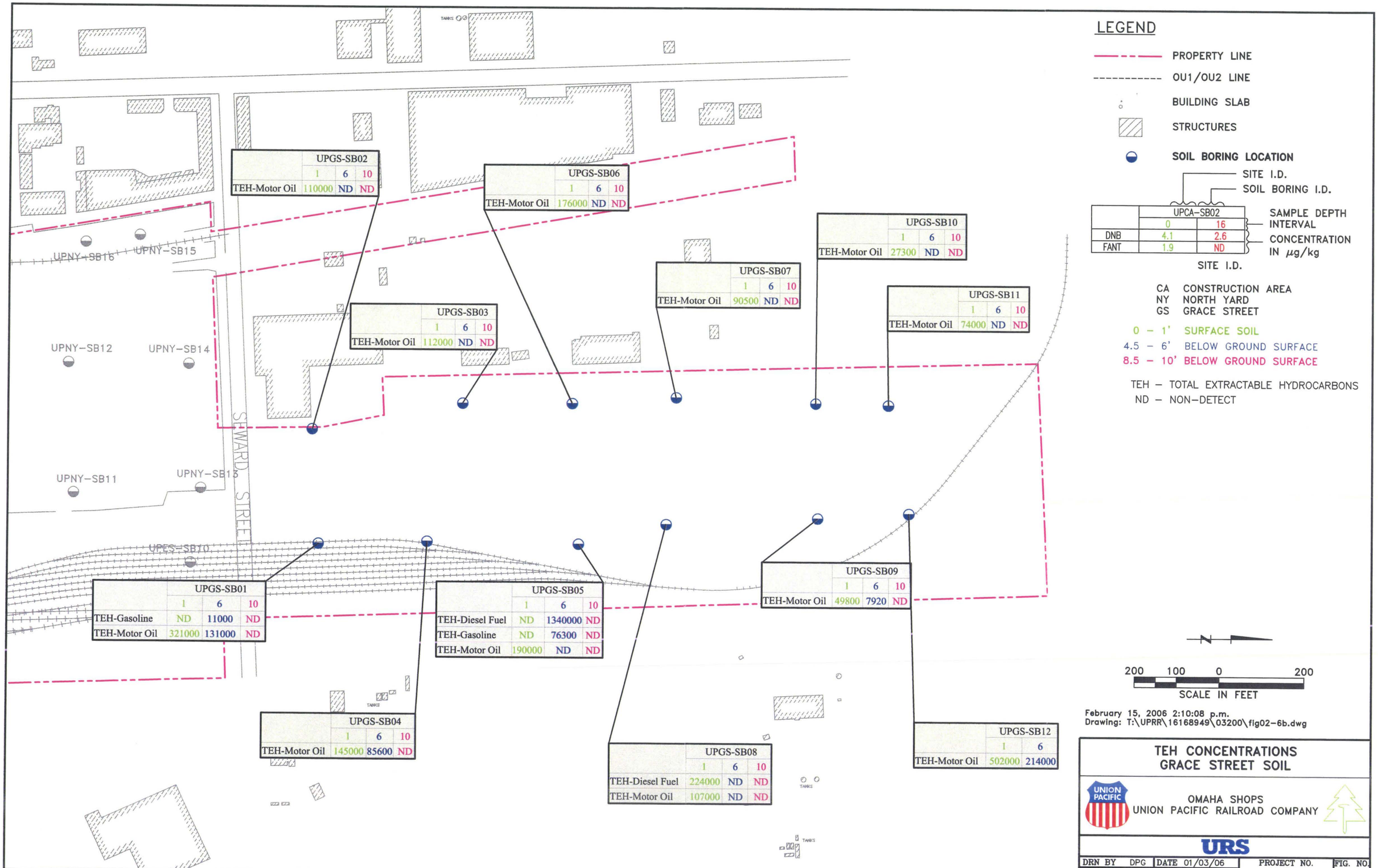
February 16, 2006 10:07:28 a.m.
Drawing: T:\16168949\04300\fig02-6a.dwg

TEH CONCENTRATIONS NORTH YARD SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE	16168949	2-6a



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D. / SOIL BORING I.D. / SAMPLE DEPTH INTERVAL / CONCENTRATION IN µg/kg

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
4.5 – 6' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE

TEH – TOTAL EXTRACTABLE HYDROCARBONS
ND – NON-DETECT

N

200 100 0 200
SCALE IN FEET

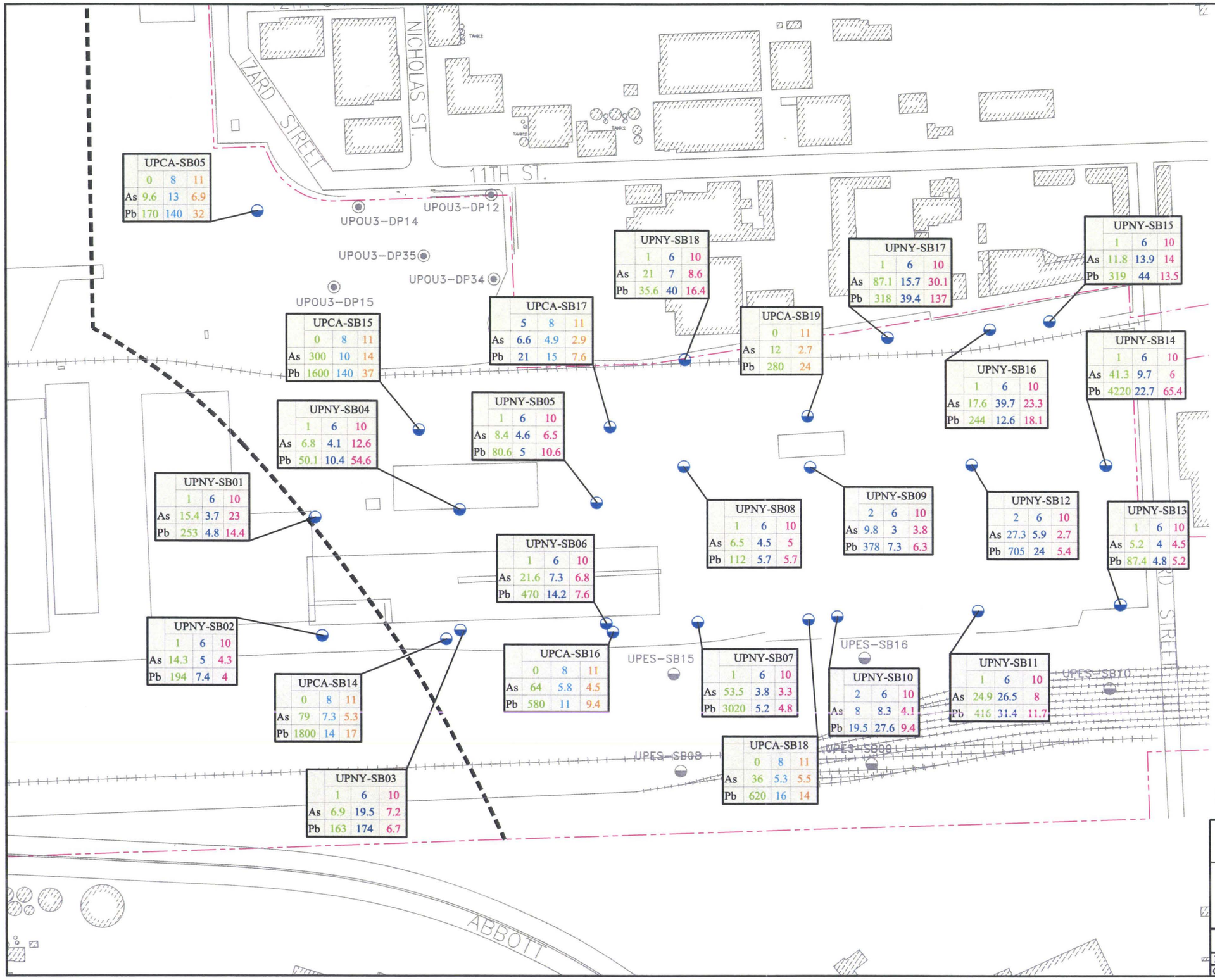
February 15, 2006 2:10:08 p.m.
Drawing: T:\UPRR\16168949\03200\fig02-6b.dwg

TEH CONCENTRATIONS GRACE STREET SOIL

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/03/06	PROJECT NO. 16168949	FIG. NO. 2-6b
CHK'D BY	DATE		



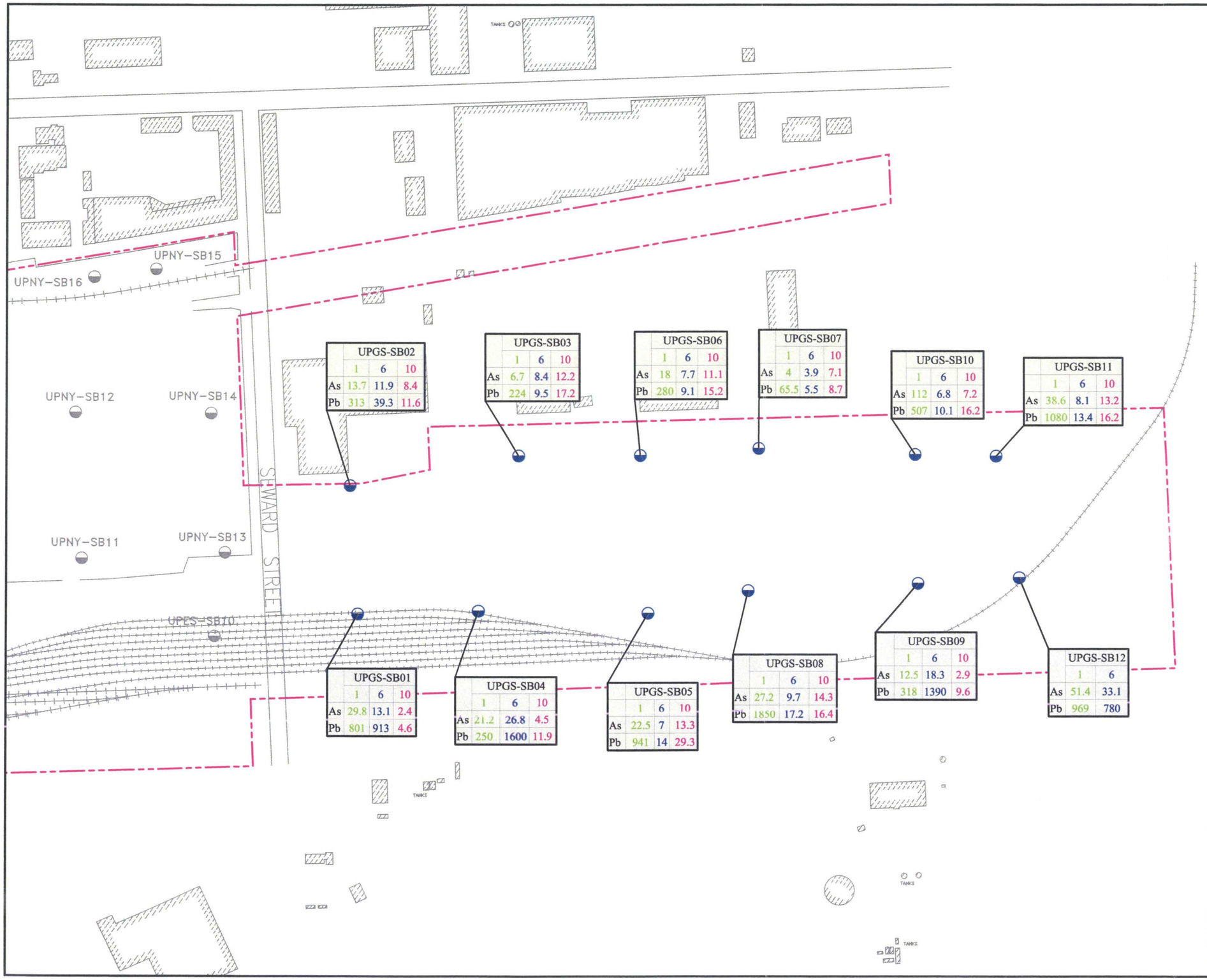
February 16, 2006 10:07:45 a.m.
Drawing: T:\16168949\04300\fig02-7a.dwg

ARSENIC/LEAD CONCENTRATIONS IN SOIL NORTH YARD

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO. 16168949	FIG. NO. 2-7a
CHK'D BY	DATE		



LEGEND

- PROPERTY LINE
- OU1/OU2 LINE
- BUILDING SLAB
- STRUCTURES
- SOIL BORING LOCATION

	SITE I.D.	SOIL BORING I.D.
	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SAMPLE DEPTH INTERVAL

CONCENTRATION IN mg/kg

SITE I.D.

CA CONSTRUCTION AREA
NY NORTH YARD
GS GRACE STREET

0 – 1' SURFACE SOIL
4.5 – 6' BELOW GROUND SURFACE
6.5 – 8' BELOW GROUND SURFACE
8.5 – 10' BELOW GROUND SURFACE
9.5 – 11' BELOW GROUND SURFACE

As –Arsenic
Pb –Lead

N

200 100 0 200
SCALE IN FEET

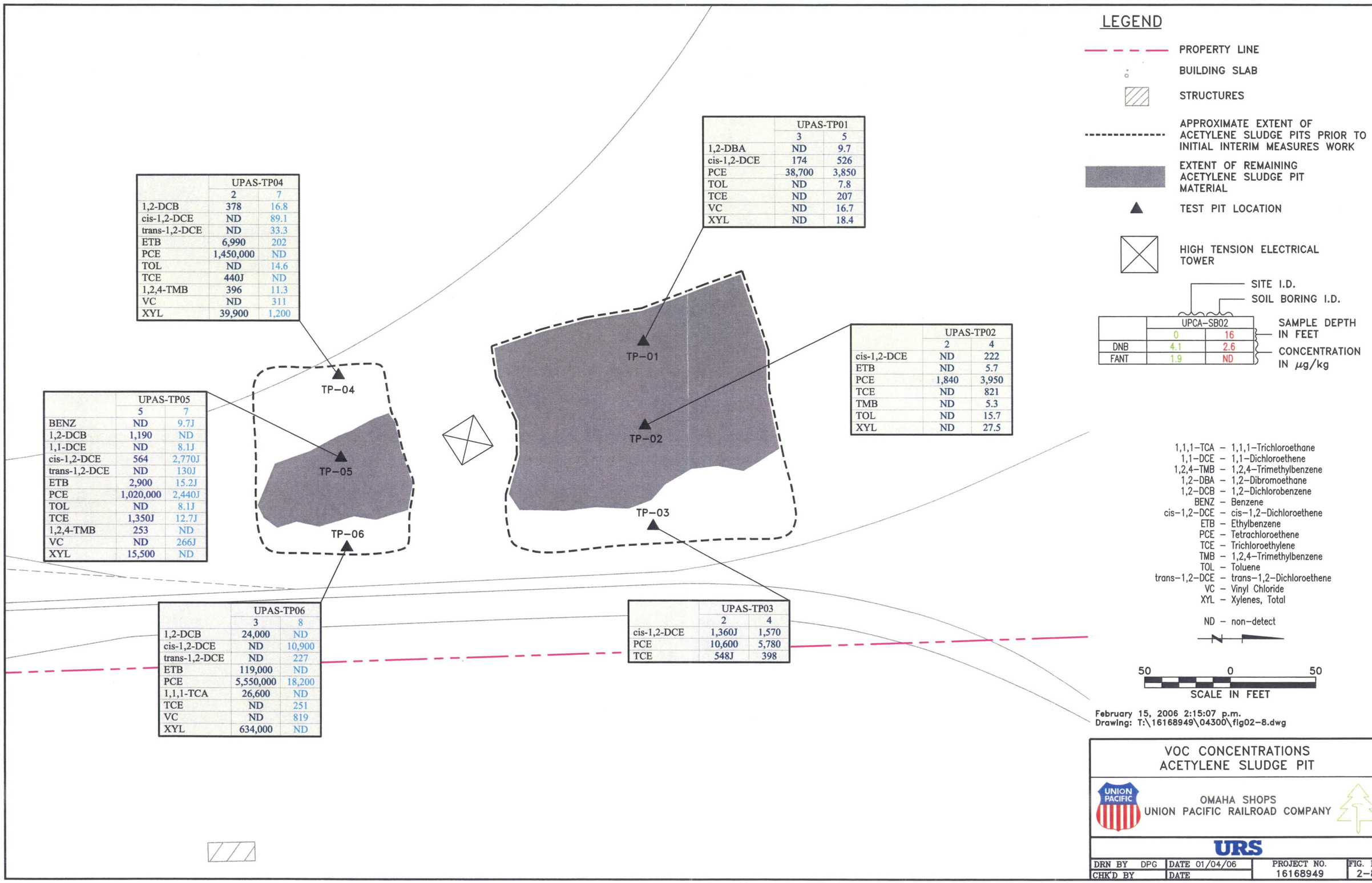
February 15, 2006 2:13:55 p.m.
Drawing: T:\16168949\04300\fig02-7b.dwg

ARSENIC/LEAD CONCENTRATIONS IN SOIL GRACE STREET

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO. 16168949	FIG. NO. 2-7b
CHK'D BY	DATE		



	UPAS-TP04	
	2	7
1,2-DCB	378	16.8
cis-1,2-DCE	ND	89.1
trans-1,2-DCE	ND	33.3
ETB	6,990	202
PCE	1,450,000	ND
TOL	ND	14.6
TCE	440J	ND
1,2,4-TMB	396	11.3
VC	ND	311
XYL	39,900	1,200

	UPAS-TP05	
	5	7
BENZ	ND	9.7J
1,2-DCB	1,190	ND
1,1-DCE	ND	8.1J
cis-1,2-DCE	564	2,770J
trans-1,2-DCE	ND	130J
ETB	2,900	15.2J
PCE	1,020,000	2,440J
TOL	ND	8.1J
TCE	1,350J	12.7J
1,2,4-TMB	253	ND
VC	ND	266J
XYL	15,500	ND

	UPAS-TP06	
	3	8
1,2-DCB	24,000	ND
cis-1,2-DCE	ND	10,900
trans-1,2-DCE	ND	227
ETB	119,000	ND
PCE	5,550,000	18,200
1,1,1-TCA	26,600	ND
TCE	ND	251
VC	ND	819
XYL	634,000	ND

	UPAS-TP01	
	3	5
1,2-DBA	ND	9.7
cis-1,2-DCE	174	526
PCE	38,700	3,850
TOL	ND	7.8
TCE	ND	207
VC	ND	16.7
XYL	ND	18.4

	UPAS-TP02	
	2	4
cis-1,2-DCE	ND	222
ETB	ND	5.7
PCE	1,840	3,950
TCE	ND	821
TMB	ND	5.3
TOL	ND	15.7
XYL	ND	27.5

	UPAS-TP03	
	2	4
cis-1,2-DCE	1,360J	1,570
PCE	10,600	5,780
TCE	548J	398

LEGEND

- PROPERTY LINE
- BUILDING SLAB
- STRUCTURES
- APPROXIMATE EXTENT OF ACETYLENE SLUDGE PITS PRIOR TO INITIAL INTERIM MEASURES WORK
- EXTENT OF REMAINING ACETYLENE SLUDGE PIT MATERIAL
- TEST PIT LOCATION
- HIGH TENSION ELECTRICAL TOWER

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D.
SOIL BORING I.D.
SAMPLE DEPTH IN FEET
CONCENTRATION IN µg/kg

1,1,1-TCA – 1,1,1-Trichloroethane
1,1-DCE – 1,1-Dichloroethene
1,2,4-TMB – 1,2,4-Trimethylbenzene
1,2-DBA – 1,2-Dibromoethane
1,2-DCB – 1,2-Dichlorobenzene
BENZ – Benzene
cis-1,2-DCE – cis-1,2-Dichloroethene
ETB – Ethylbenzene
PCE – Tetrachloroethene
TCE – Trichloroethylene
TMB – 1,2,4-Trimethylbenzene
TOL – Toluene
trans-1,2-DCE – trans-1,2-Dichloroethene
VC – Vinyl Chloride
XYL – Xylenes, Total

ND – non-detect

50 0 50
SCALE IN FEET

February 15, 2006 2:15:07 p.m.
Drawing: T:\16168949\04300\fig02-8.dwg

VOC CONCENTRATIONS ACETYLENE SLUDGE PIT

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE	16168949	2-8

	UPAS-TP01	
	3	5
BENZA	3.1	ND
BENZP	2.3	ND
BENBF	2.4	ND
BENKF	2.6	ND
CHR	3	ND
FANT	9.2	ND
NAP	ND	0.154
PHEN	7.1	ND
PYR	8.9	ND
TEH - Motor Oil	300J	ND

	UPAS-TP05	
	5	7
ANT	0.66	ND
BENZA	1.7	ND
BENZP	1.5	ND
BENBF	1.5	ND
BENKF	1.3	ND
CHR	1.7	ND
FANT	4.6	ND
2-MNAP	1.2	ND
PHEN	3.7	ND
PYR	4.2	ND
1260	0.067J	ND
TEH - Motor Oil	350J	ND

	UPAS-TP04	
	2	7
PHEN	0.72	ND
1260	0.31J	ND
TEH - Motor Oil	290J	ND

	UPAS-TP02	
	2	4
1260	0.48	ND
TEH - Motor Oil	850J	ND

	UPAS-TP06	
	3	8
CHR	ND	0.52
FANT	ND	1.2J
2-MNAP	4.1J	ND
PHEN	5.6J	1.2J
PYR	ND	0.97J
TEH - Motor Oil	13,000J	130J

	UPAS-TP03	
	2	4
ANT	ND	2.9J
BENZA	ND	14.2J
BENZP	ND	15.9J
BENBF	ND	13.8J
BENGHIP	ND	8.1J
BENKF	ND	14.2J
CHR	ND	14.4J
DBENA	ND	3.3J
FANT	ND	17.9J
ICDP	ND	8.3J
PHEN	ND	9.7J
PYR	ND	17.3J
TEH - Motor Oil	11,000J	450

TP-01
TP-02
TP-03
TP-04
TP-05
TP-06

LEGEND

- PROPERTY LINE
- BUILDING SLAB
- STRUCTURES
- APPROXIMATE EXTENT OF ACETYLENE SLUDGE PITS PRIOR TO INITIAL INTERIM MEASURES WORK
- EXTENT OF REMAINING ACETYLENE SLUDGE PIT MATERIAL
- TEST PIT LOCATION
- HIGH TENSION ELECTRICAL TOWER

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D.
SOIL BORING I.D.
SAMPLE DEPTH IN FEET
CONCENTRATION IN µg/g

1260 – Aroclor 1260
2-MNAP – 2-Methylnaphthalene
ANT – Anthracene
BENBF – Benzo(b)fluoranthene
BENGHIP – Benzo(ghi)perylene
BENKF – Benzo(k)fluoranthene
BENZA – Benzo(a)anthracene
BENZP – Benzo(a)pyrene
CHR – Chrysene
DBENA – Dibenzo(a,h)anthracene
FANT – Fluoranthene
ICDP – Indeno(1,2,3-cd)pyrene
NAP – Naphthalene
PHEN – Phenanthrene
PYR – Pyrene
TEH – Motor Oil – TEH – Motor Oil

ND – non-detect

N

50 0 50

SCALE IN FEET

February 15, 2006 2:16:20 p.m.
Drawing: T:\16168949\04300\fig02-9.dwg

SVOC/PCB/TEH CONCENTRATIONS ACETYLENE SLUDGE PIT

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO. 16168949	FIG. NO. 2-9
CHK'D BY	DATE		

	UPAS-TP01	
	3	5
As	7.4	3.4
Pb	450	8.2

	UPAS-TP04	
	2	7
As	ND	1.8
Pb	38	6.3

	UPAS-TP05	
	5	7
As	1.5	5
Pb	180	8

	UPAS-TP02	
	2	4
As	ND	4.4
Pb	88	5.9

	UPAS-TP06	
	3	8
As	2.1	7.1
Pb	160	120

	UPAS-TP03	
	2	4
As	26J	7
Pb	320J	3400

TP-01
TP-02
TP-03
TP-04
TP-05
TP-06

LEGEND

- PROPERTY LINE
- BUILDING SLAB
- STRUCTURES
- APPROXIMATE EXTENT OF ACETYLENE SLUDGE PITS PRIOR TO INITIAL INTERIM MEASURES WORK
- EXTENT OF REMAINING ACETYLENE SLUDGE PIT MATERIAL
- TEST PIT LOCATION
- HIGH TENSION ELECTRICAL TOWER

	UPCA-SB02	
	0	16
DNB	4.1	2.6
FANT	1.9	ND

SITE I.D.
SOIL BORING I.D.
SAMPLE DEPTH IN FEET
CONCENTRATION IN mg/kg

As – Arsenic
Pb – Lead

ND – non-detect

N

50 0 50
SCALE IN FEET

February 15, 2006 2:17:33 p.m.
Drawing: T:\16168949\04300\fig02-10.dwg

ARSENIC/LEAD CONCENTRATIONS ACETYLENE SLUDGE PIT

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE	16168949	2-10

A RCRA Interim Measure (IM) was completed for the areas containing asbestos-impacted soil at the UPRR Omaha Shops. Excavation activities began on June 13, 2000. Approximately 41,500 cubic yards of soil were removed and trucked to the Butler County landfill for disposal and 5,000 cubic yards of soil were excavated and placed in the new Abbott Drive/Cumings Street roadway embankment. Analytical results indicated that the asbestos excavations were completed on December 1, 2000. The Asbestos Pits were backfilled with "clean" imported soil. The rationale and recommendations in this document are based on information detailed in the Asbestos Interim Measure Completion Report (URS 2001a).

The purpose of the Asbestos IM was to remove and dispose of soil containing greater than 1 percent asbestos. Five areas were identified to contain asbestos-impacted soil in Operable Unit No. 1 (OU1) and OU2 (Figure 3-1). Asbestos Pit 5 is located within OU2, Asbestos Pit 4 is located in both OU1 and OU2, and Asbestos Pits 1, 2, and 3 are located within OU1. Soil impacted by asbestos was excavated and disposed of at Butler County Landfill in David City, Nebraska. Confirmation soil samples were collected and the excavations were backfilled with clean soil after the confirmation samples came back at or below 1 percent.

3.1 FIELD ACTIVITIES

The planned excavations included the top 12 inches of soil from Pits 1, 2, and 3, and 18 inches of soil from 1.5 to 3 feet below ground surface from Pits 4 and 5 using a backhoe. The planned limits of the excavation were based on the analytical results for subsurface soil samples collected in January 1999. Initial excavation activities were continued until all of the soil containing asbestos was removed. The actual limits of the excavations are shown on Figure 3-2 and a total of 510 soil samples were collected for asbestos analysis.

Excavated materials were loaded into lined trucks, manifested, and transported to the Butler County Landfill in accordance with Federal, State, and local laws for disposal.

Confirmation soil samples were collected from the sidewalls and bottoms of the excavations using a stainless-steel spoon and analyzed for asbestos (Figure 3-2). The confirmation sample analytical results were used to verify that remaining soils do not exceed 1 percent asbestos. The sample material was placed directly into zip-lock bags, labeled, packaged, and shipped to the Dames & Moore (URS) laboratory for asbestos analysis. Confirmation soil sample results were compared to the action level of 1 percent. If the results exceeded 1 percent, excavation activities were continued, followed by re-collection of confirmation samples in the newly excavated area.

After the confirmation samples came back at or below 1 percent, the excavations were backfilled with "clean" fill soils. The soils were compacted in the excavation to minimize future settling.

3.2 ASBESTOS PIT 4

Asbestos Pit 4 excavation started on June 20, 2000. The lateral extents of Pit 4 were originally planned to be 25 feet by 25 feet, with 18 inches of soil removed between 1.5 to 3 feet in depth. However, once excavation began, the volume (based upon investigative sampling) expanded greatly. To aid in the delineation of the contaminated extents, potholes were excavated radially

from the main excavation. A total of 403 random confirmation soil samples were collected from the walls and floor of the excavation (Table 3-1). Final confirmation sampling indicated that Asbestos Pit 4 was cleared for backfill on December 1, 2000. The total volume removed was 39,937 cubic yards (cy), which also includes the pothole excavation quantities. Upon approval by the Nebraska Department of Environmental Quality, 5,015 cy of material was left on site as part of the relocated Abbott Drive/Cumings Street roadway embankment (Figure 3-3).

3.3 ASBESTOS PIT 5

Asbestos Pit 5 excavation started on June 20, 2000. A total of 5 random confirmation soil samples were collected. One composite confirmation sample was collected from each of the four faces and the bottom of the excavation. Analytical results indicated that the remaining soil was below the action level and the pit was cleared for backfill on June 21, 2000 (Table 3-2). The total volume removed was 22 cy.

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 001	Middle Floor	6/20/2000	4	No	
UPRR - ASB4 - 002	NW Wall	6/20/2000	3	No	
UPRR - ASB4 - 003	NE Wall	6/20/2000	3	No	
UPRR - ASB4 - 004	SE Wall	6/20/2000	3	No	
UPRR - ASB4 - 005	SW Wall	6/20/2000	5	No	
UPRR - ASB4 - 001A	Middle Floor	6/28/2000	2	No	
UPRR - ASB4 - 002A	NW Wall	6/28/2000	2	No	
UPRR - ASB4 - 003A	NE Wall	6/28/2000	5	No	
UPRR - ASB4 - 004A	SE Wall	6/28/2000	4	No	
UPRR - ASB4 - 005A	SW Wall	6/28/2000	5	No	
UPRR - ASB4 - 002B	North Wall	7/18/2000	2	No	
UPRR - ASB4 - 003B	East Wall	7/18/2000	4	No	
UPRR - ASB4 - 004B	South Wall	7/18/2000	8	No	
UPRR - ASB4 - 005B	West Wall	7/18/2000	12	No	
UPRR - ASB4 - 001B	Middle Floor	7/20/2000	<1	Yes	
UPRR - ASB4 - 001	North Wall	7/27/2000	<1	Yes	
UPRR - ASB4 - 002	North Wall	7/27/2000	1	No	
UPRR - ASB4 - 003	North Wall	7/27/2000	3	No	
UPRR - ASB4 - 004	East Wall	7/27/2000	2	No	
UPRR - ASB4 - 005	East Wall	7/27/2000	4	No	
UPRR - ASB4 - 006	East Wall	7/27/2000	NAD	Yes	
UPRR - ASB4 - 007	South Wall	7/27/2000	3	No	
UPRR - ASB4 - 008	South Wall	7/27/2000	3	No	
UPRR - ASB4 - 009	South Wall	7/27/2000	<1	Yes	
UPRR - ASB4 - 010	West Wall	7/27/2000	<1	Yes	
UPRR - ASB4 - 011	West Wall	7/27/2000	2	No	
UPRR - ASB4 - 012	West Wall	7/27/2000	<1	Yes	
UPRR - ASB4 - 001A	North Wall	8/2/2000	NAD	Yes	
UPRR - ASB4 - 002A	North Wall	8/2/2000	NAD	Yes	
UPRR - ASB4 - 003A	North Wall	8/2/2000	3	No	
UPRR - ASB4 - 004A	East Wall	8/2/2000	1	Yes	
UPRR - ASB4 - 005A	East Wall	8/2/2000	8	No	
UPRR - ASB4 - 006A	South Wall	8/2/2000	12	No	
UPRR - ASB4 - 007A	South Wall	8/2/2000	25	No	
UPRR - ASB4 - 008A	West Wall	8/2/2000	17	No	
UPRR - ASB4 - 009A	West Wall	8/2/2000	29	No	
UPRR - ASB4 - 001B	North Wall	8/7/2000	1	Yes	
UPRR - ASB4 - 002B	East Wall	8/7/2000	2	No	
UPRR - ASB4 - 003B	East Wall	8/7/2000	5	No	
UPRR - ASB4 - 004B	South Wall	8/7/2000	3	No	
UPRR - ASB4 - 005B	South Wall	8/7/2000	2	No	
UPRR - ASB4 - 006B	West Wall	8/7/2000	7	No	
UPRR - ASB4 - 007B	West Wall	8/7/2000	4	No	
UPRR - ASB4 - 001C	East Wall	8/10/2000	12	No	
UPRR - ASB4 - 002C	East Wall	8/10/2000	2	No	

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 003C	East Wall	8/10/2000	3	No	
UPRR - ASB4 - 004C	East Wall	8/10/2000	2	No	
UPRR - ASB4 - 005C	South Wall	8/12/2000	3	No	
UPRR - ASB4 - 006C	South Wall	8/12/2000	2	No	
UPRR - ASB4 - 007C	South Wall	8/12/2000	3	No	
UPRR - ASB4 - 008C	South Wall	8/12/2000	4	No	
UPRR - ASB4 - 009C	West Wall	8/12/2000	4	No	
UPRR - ASB4 - 010C	West Wall	8/12/2000	9	No	
UPRR - ASB4 - 011C	West Wall	8/12/2000	1	Yes	
UPRR - ASB4 - 012C	West Wall	8/12/2000	2	No	
UPRR - ASB4 - 001D	East Wall	8/17/2000	3	No	
UPRR - ASB4 - 002D	East Wall	8/17/2000	NAD	Yes	
UPRR - ASB4 - 003D	East Wall	8/17/2000	<1	Yes	
UPRR - ASB4 - 004D	East Wall	8/17/2000	2	No	
UPRR - ASB4 - 005D	South Wall	8/17/2000	5	No	
UPRR - ASB4 - 006D	South Wall	8/17/2000	7	No	
UPRR - ASB4 - 007D	South Wall	8/17/2000	9	No	
UPRR - ASB4 - 008D	South Wall	8/17/2000	13	No	
UPRR - ASB4 - 009D	West Wall	8/17/2000	4	No	
UPRR - ASB4 - 010D	West Wall	8/17/2000	3	No	
UPRR - ASB4 - 011D	West Wall	8/17/2000	5	No	
UPRR - ASB4 - 012D	West Wall	8/17/2000	8	No	
UPRR - ASB4 - 001E	West Wall	8/23/2000	7	No	
UPRR - ASB4 - 002E	West Wall	8/23/2000	1	Yes	
UPRR - ASB4 - 003E	West Wall	8/23/2000	4	No	
UPRR - ASB4 - 004E	SW Wall	8/23/2000	1	No	
UPRR - ASB4 - 005E	SW Wall	8/23/2000	<1	Yes	
UPRR - ASB4 - 006E	SW Wall	8/23/2000	<1	Yes	
UPRR - ASB4 - 007E	West Wall	8/23/2000	2	No	
UPRR - ASB4 - 008E	West Wall	8/23/2000	5	No	
UPRR - ASB4 - 009E	West Wall	8/23/2000	2	No	
UPRR - ASB4 - 010E	West Wall	8/23/2000	2	No	
UPRR - ASB4 - 011E	West Wall	8/23/2000	8	No	
UPRR - ASB4 - 012E	North Wall	8/24/2000	5	No	
UPRR - ASB4 - 013E	North Wall	8/24/2000	3	No	
UPRR - ASB4 - 014E	East Wall	8/24/2000	6	No	
UPRR - ASB4 - 015E	East Wall	8/24/2000	3	No	
UPRR - ASB4 - 016E	East Wall	8/24/2000	4	No	
UPRR - ASB4 - 017E	East Wall	8/24/2000	4	No	
UPRR - ASB4 - 018E	South Wall	8/24/2000	2	No	
UPRR - ASB4 - 019E	South Wall	8/24/2000	3	No	
UPRR - ASB4 - 020E	South Wall	8/24/2000	2	No	
UPRR - ASB4 - 021E	South Wall	8/24/2000	5	No	
UPRR - ASB4 - 022E	South Wall	8/24/2000	5	No	
UPRR - ASB4 - 001F	South Wall	8/25/2000	8	No	

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 002F	South Wall	8/25/2000	3	No	
UPRR - ASB4 - 003F	South Wall	8/25/2000	2	No	
UPRR - ASB4 - 004F	South Wall	8/25/2000	5	No	
UPRR - ASB4 - 005F	South Wall	8/25/2000	2	No	
UPRR - ASB4 - 006F	South Wall	8/25/2000	3	No	
UPRR - ASB4 - 007F	North Wall	8/28/2000	2	No	
UPRR - ASB4 - 008F	North Wall	8/28/2000	2	No	
UPRR - ASB4 - 009F	North Wall	8/28/2000	4	No	
UPRR - ASB4 - 010F	North Wall	8/28/2000	5	No	
UPRR - ASB4 - 011F	North Wall	8/28/2000	4	No	
UPRR - ASB4 - 012F	North Wall	8/28/2000	3	No	
UPRR - ASB4 - 013F	North Wall	8/28/2000	7	No	
UPRR - ASB4 - 014F	North Wall	8/28/2000	8	No	
UPRR - ASB4 - 015F	North Wall	8/28/2000	7	No	
UPRR - ASB4 - 016F	North Wall	8/28/2000	2	No	
UPRR - ASB4 - 017F	North Wall	8/28/2000	6	No	
UPRR - ASB4 - 018F	North Wall	8/28/2000	15	No	
UPRR - ASB4 - 019F	North Wall	8/28/2000	5	No	
UPRR - ASB4 - 020F	North Wall	8/28/2000	3	No	
UPRR - ASB4 - 021F	North Wall	8/28/2000	3	No	
UPRR - ASB4 - 022F	North Wall	8/28/2000	5	No	
UPRR - ASB4 - 023F	North Wall	8/28/2000	4	No	
UPRR - ASB4 - 024F	North Wall	8/28/2000	3	No	
UPRR - ASB4 - 025F	North Wall	8/28/2000	4	No	
UPRR - ASB4 - 026F	North Wall	8/28/2000	NAD	Yes	9/1/2000
UPRR - ASB4 - 027F	North Wall	8/28/2000	3	No	
UPRR - ASB4 - 028F	North Wall	8/28/2000	NAD	Yes	9/1/2000
UPRR - ASB4 - 029F	North Wall	8/28/2000	7	No	
UPRR - ASB4 - 030F	North Wall	8/28/2000	2	No	
UPRR - ASB4 - 031F	West Wall	8/28/2000	2	No	
UPRR - ASB4 - 032F	West Wall	8/28/2000	NAD	Yes	9/1/2000
UPRR - ASB4 - 033F	West Wall	8/28/2000	3	No	
UPRR - ASB4 - 034F	West Wall	8/28/2000	4	No	
UPRR - ASB4 - 035F	West Wall	8/28/2000	2	No	
UPRR - ASB4 - 036F	West Wall	8/28/2000	2	No	
UPRR - ASB4 - 037F	West Wall	8/28/2000	3	No	
UPRR - ASB4 - 038F	West Wall	8/28/2000	2	No	
UPRR - ASB4 - 001G	South Wall	8/30/2000	2	No	
UPRR - ASB4 - 002G	South Wall	8/30/2000	2	No	
UPRR - ASB4 - 003G	South Wall	8/30/2000	<1	Yes	9/26/2000
UPRR - ASB4 - 004G	South Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 005G	South Wall	8/30/2000	3	No	
UPRR - ASB4 - 006G	South Wall	8/30/2000	2	No	
UPRR - ASB4 - 007G	South Wall	8/30/2000	7	No	
UPRR - ASB4 - 008G	South Wall	8/30/2000	4	No	

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 009G	South Wall	8/30/2000	3	No	
UPRR - ASB4 - 010G	South Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 011G	South Wall	8/30/2000	3	No	
UPRR - ASB4 - 012G	South Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 013G	West Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 014G	West Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 015G	West Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 016G	West Wall	8/30/2000	2	No	
UPRR - ASB4 - 017G	West Wall	8/30/2000	4	No	
UPRR - ASB4 - 018G	West Wall	8/30/2000	5	No	
UPRR - ASB4 - 019G	West Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 020G	West Wall	8/30/2000	3	No	
UPRR - ASB4 - 021G	SW Wall	8/30/2000	1	Yes	9/26/2000
UPRR - ASB4 - 022G	SW Wall	8/30/2000	NAD	Yes	9/26/2000
UPRR - ASB4 - 023G	SW Wall	8/30/2000	<1	Yes	9/26/2000
UPRR - ASB4 - 024G	SW Wall	8/30/2000	3	No	
UPRR - ASB4 - 025G	North Wall	8/31/2000	4	No	
UPRR - ASB4 - 026G	North Wall	8/31/2000	2	No	
UPRR - ASB4 - 027G	North Wall	8/31/2000	3	No	
UPRR - ASB4 - 028G	North Wall	8/31/2000	8	No	
UPRR - ASB4 - 029G	North Wall	8/31/2000	7	No	
UPRR - ASB4 - 030G	North Wall	8/31/2000	1	Yes	9/26/2000
UPRR - ASB4 - 031G	North Wall	8/31/2000	7	No	
UPRR - ASB4 - 032G	North Wall	8/31/2000	2	No	
UPRR - ASB4 - 033G	North Wall	8/31/2000	2	No	
UPRR - ASB4 - 034G	North Wall	8/31/2000	1	Yes	9/26/2000
UPRR - ASB4 - 035G	North Wall	8/31/2000	2	No	
UPRR - ASB4 - 036G	North Wall	8/31/2000	3	No	
UPRR - ASB4 - 037G	North Wall	8/31/2000	8	No	
UPRR - ASB4 - 038G	North Wall	8/31/2000	5	No	
UPRR - ASB4 - 039G	East Wall	8/31/2000	<1	Yes	9/26/2000
UPRR - ASB4 - 040G	East Wall	8/31/2000	<1	Yes	9/26/2000
UPRR - ASB4 - 041G	East Wall	8/31/2000	1	Yes	9/26/2000
UPRR - ASB4 - 042G	East Wall	8/31/2000	3	No	
UPRR - ASB4 - 043G	East Wall	9/5/2000	10	No	
UPRR - ASB4 - 044G	East Wall	9/5/2000	2	No	
UPRR - ASB4 - 045G	East Wall	9/5/2000	1	Yes	9/26/2000
UPRR - ASB4 - 046G	East Wall	9/5/2000	1	Yes	9/26/2000
UPRR - ASB4 - 047G	East Wall	9/5/2000	4	No	
UPRR - ASB4 - 048G	East Wall	9/5/2000	4	No	
UPRR - ASB4 - 001H	South Wall	9/6/2000	2	No	
UPRR - ASB4 - 002H	South Wall	9/6/2000	2	No	
UPRR - ASB4 - 003H	South Wall	9/6/2000	3	No	
UPRR - ASB4 - 004H	South Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 005H	South Wall	9/6/2000	1	Yes	10/3/2000

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 006H	South Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 007H	South Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 008H	South Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 009H	West Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 010H	West Wall	9/6/2000	2	No	
UPRR - ASB4 - 011H	West Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 012H	West Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 013H	West Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 014H	West Wall	9/6/2000	1	Yes	10/3/2000
UPRR - ASB4 - 015H	West Wall	9/6/2000	<1	Yes	10/3/2000
UPRR - ASB4 - 016H	West Wall	9/6/2000	2	No	
UPRR - ASB4 - 017H	West Wall	9/6/2000	<1	Yes	10/3/2000
UPRR - ASB4 - 018H	West Wall	9/6/2000	<1	Yes	10/3/2000
UPRR - ASB4 - 019H	West Wall	9/6/2000	2	No	
UPRR - ASB4 - 020H	West Wall	9/6/2000	<1	Yes	10/3/2000
UPRR - ASB4 - 021H	North Wall	9/8/2000	10	No	
UPRR - ASB4 - 022H	North Wall	9/8/2000	1	Yes	10/5/2000
UPRR - ASB4 - 023H	North Wall	9/8/2000	8	No	
UPRR - ASB4 - 024H	North Wall	9/8/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 025H	North Wall	9/8/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 026H	North Wall	9/8/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 027H	North Wall	9/8/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 028H	North Wall	9/8/2000	4	No	
UPRR - ASB4 - 029H	North Wall	9/8/2000	1	Yes	10/5/2000
UPRR - ASB4 - 030H	North Wall	9/8/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 031H	West Wall	9/11/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 032H	West Wall	9/11/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 033H	West Wall	9/11/2000	1	Yes	10/5/2000
UPRR - ASB4 - 034H	West Wall	9/11/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 035H	West Wall	9/11/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 036H	West Wall	9/11/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 037H	West Wall	9/11/2000	4	No	
UPRR - ASB4 - 038H	West Wall	9/11/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 039H	West Wall	9/11/2000	1	Yes	10/5/2000
UPRR - ASB4 - 040H	West Wall	9/11/2000	1	Yes	10/5/2000
UPRR - ASB4 - 001i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 002i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 003i	East Wall	9/25/2000	1	Yes	10/5/2000
UPRR - ASB4 - 004i	East Wall	9/25/2000	1	Yes	10/5/2000
UPRR - ASB4 - 005i	East Wall	9/25/2000	1	Yes	10/5/2000
UPRR - ASB4 - 006i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 007i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 008i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 009i	East Wall	9/25/2000	1	Yes	10/5/2000
UPRR - ASB4 - 010i	East Wall	9/25/2000	1	Yes	10/5/2000

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 011i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 012i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 013i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 014i	East Wall	9/25/2000	4	No	
UPRR - ASB4 - 015i	East Wall	9/25/2000	2	No	
UPRR - ASB4 - 016i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 017i	East Wall	9/25/2000	1	Yes	10/5/2000
UPRR - ASB4 - 018i	East Wall	9/25/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 019i	East Wall	9/25/2000	2	No	
UPRR - ASB4 - 020i	South Wall	9/27/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 021i	South Wall	9/27/2000	1	Yes	10/5/2000
UPRR - ASB4 - 022i	South Wall	9/27/2000	1	Yes	10/5/2000
UPRR - ASB4 - 023i	South Wall	9/27/2000	1	Yes	10/5/2000
UPRR - ASB4 - 024i	South Wall	9/27/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 025i	South Wall	9/27/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 026i	South Wall	9/27/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 027i	South Wall	9/27/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 028i	South Wall	9/27/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 001FL	Floor	10/4/2000	1	Yes	10/5/2000
UPRR - ASB4 - 002FL	Floor	10/4/2000	1	Yes	10/5/2000
UPRR - ASB4 - 003FL	Floor	10/4/2000	1	Yes	10/5/2000
UPRR - ASB4 - 004FL	Floor	10/4/2000	1	Yes	10/5/2000
UPRR - ASB4 - 005FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 006FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 007FL	Floor	10/4/2000	2	No	
UPRR - ASB4 - 008FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 009FL	Floor	10/4/2000	3	No	
UPRR - ASB4 - 010FL	Floor	10/4/2000	2	No	
UPRR - ASB4 - 011FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 012FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 013FL	Floor	10/4/2000	1	Yes	10/5/2000
UPRR - ASB4 - 014FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 015FL	Floor	10/4/2000	2	No	
UPRR - ASB4 - 016FL	Floor	10/4/2000	3	No	
UPRR - ASB4 - 017FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 018FL	Floor	10/4/2000	<1	Yes	10/5/2000
UPRR - ASB4 - 029i	North Wall	10/5/2000	7	No	
UPRR - ASB4 - 030i	North Wall	10/5/2000	<1	Yes	10/6/2000
UPRR - ASB4 - 031i	North Wall	10/5/2000	6	No	
UPRR - ASB4 - 032i	North Wall	10/5/2000	4	No	
UPRR - ASB4 - 033i	North Wall	10/5/2000	1	Yes	10/6/2000
UPRR - ASB4 - 034i	North Wall	10/5/2000	1	Yes	10/6/2000
UPRR - ASB4 - 035i	North Wall	10/5/2000	2	No	
UPRR - ASB4 - 036i	North Wall	10/5/2000	2	No	
UPRR - ASB4 - 037i	North Wall	10/5/2000	2	No	

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 038i	North Wall	10/5/2000	<1	Yes	10/6/2000
UPRR - ASB4 - 039i	North Wall	10/5/2000	<1	Yes	10/6/2000
UPRR - ASB4 - 040i	North Wall	10/5/2000	<1	Yes	10/6/2000
UPRR - ASB4 - 041i	North Wall	10/5/2000	<1	Yes	10/6/2000
UPRR - ASB4 - 001J	East Wall	10/6/2000	1	Yes	10/9/2000
UPRR - ASB4 - 002J	East Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 003J	East Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 004J	East Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 005J	East Wall	10/6/2000	1	Yes	10/9/2000
UPRR - ASB4 - 006J	East Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 007J	West Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 008J	West Wall	10/6/2000	3	No	
UPRR - ASB4 - 009J	West Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 010J	West Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 011J	West Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 012J	West Wall	10/6/2000	2	no	
UPRR - ASB4 - 013J	S Corner Wall	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 014J	S Corner Wall	10/6/2000	1	Yes	10/9/2000
UPRR - ASB4 - 019FL	Floor	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 020FL	Floor	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 021FL	Floor	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 022FL	Floor	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 023FL	Floor	10/6/2000	<1	Yes	10/9/2000
UPRR - ASB4 - 015J	South Wall	10/7/2000	2	No	
UPRR - ASB4 - 016J	South Wall	10/7/2000	1	Yes	10/10/2000
UPRR - ASB4 - 017J	South Wall	10/7/2000	2	No	
UPRR - ASB4 - 018J	South Wall	10/7/2000	7	No	
UPRR - ASB4 - 019J	South Wall	10/7/2000	3	No	
UPRR - ASB4 - 020J	South Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 021J	South Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 022J	South Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 023J	South Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 024J	South Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 025J	South Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 026J	North Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 027J	North Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 028J	North Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 029J	North Wall	10/7/2000	2	No	
UPRR - ASB4 - 030J	North Wall	10/7/2000	2	No	
UPRR - ASB4 - 031J	North Wall	10/7/2000	<1	Yes	10/10/2000
UPRR - ASB4 - 032J	North Wall	10/7/2000	2	No	
UPRR - ASB4 - 024FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 025FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 026FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 027FL	Floor	10/9/2000	<1	Yes	10/11/2000

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 028FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 029FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 030FL	Floor	10/9/2000	1	Yes	10/11/2000
UPRR - ASB4 - 031FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 032FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 033FL	Floor	10/9/2000	1	Yes	10/11/2000
UPRR - ASB4 - 034FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 035FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 036FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 037FL	Floor	10/9/2000	1	Yes	10/11/2000
UPRR - ASB4 - 038FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 039FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 040FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 041FL	Floor	10/9/2000	4	No	
UPRR - ASB4 - 042FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 043FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 044FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 045FL	Floor	10/9/2000	3	No	
UPRR - ASB4 - 046FL	Floor	10/9/2000	1	Yes	10/11/2000
UPRR - ASB4 - 047FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 048FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 049FL	Floor	10/9/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 001K	SE Corner Wall	10/10/2000	3	No	
UPRR - ASB4 - 002K	South Wall	10/10/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 003K	South Wall	10/10/2000	1	Yes	10/11/2000
UPRR - ASB4 - 004K	South Wall	10/10/2000	1	Yes	10/11/2000
UPRR - ASB4 - 005K	South Wall	10/10/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 006K	South Wall	10/10/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 007K	West Wall	10/10/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 008K	West Wall	10/10/2000	<1	Yes	10/11/2000
UPRR - ASB4 - 009K	North Wall	10/11/2000	5	No	
UPRR - ASB4 - 010K	North Wall	10/11/2000	3	No	
UPRR - ASB4 - 011K	North Wall	10/11/2000	2	No	
UPRR - ASB4 - 012K	North Wall	10/11/2000	<1	Yes	10/12/2000
UPRR - ASB4 - 050FL	Floor	10/11/2000	NAD	Yes	10/12/2000
UPRR - ASB4 - 051FL	Floor	10/11/2000	<1	Yes	10/12/2000
UPRR - ASB4 - 013K	SE, East Wall	10/12/2000	<1	Yes	10/13/2000
UPRR - ASB4 - 014K	SE, East Wall	10/12/2000	1	Yes	10/13/2000
UPRR - ASB4 - 015K	SE, East Wall	10/12/2000	<1	Yes	10/13/2000
UPRR - ASB4 - 016K	SE, East Wall	10/12/2000	1	Yes	10/13/2000
UPRR - ASB4 - 017K	SE, East Wall	10/12/2000	1	Yes	10/13/2000
UPRR - ASB4 - 018K	SE, East Wall	10/12/2000	<1	Yes	10/13/2000
UPRR - ASB4 - 001L	NE Wall	12/4/2000	5	No	
UPRR - ASB4 - 002L	NE Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 003L	NE Wall	12/4/2000	3	No	

TABLE 3-1

ASBESTOS PIT 4
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB4 - 004L	NE Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 005L	North Wall	12/4/2000	5	No	
UPRR - ASB4 - 006L	North Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 007L	North Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 008L	North Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 009L	NW Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 010L	NW Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 011L	NW Wall	12/4/2000	2	No	
UPRR - ASB4 - 012L	NW Wall	12/4/2000	1	Yes	12/5/2000
UPRR - ASB4 - 001M	NE Wall	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 002M	NE Wall	12/5/2000	1	Yes	12/6/2000
UPRR - ASB4 - 003M	North Wall	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 014M	NW Wall	12/5/2000	5	No	
UPRR - ASB4 - 052FL	Floor	12/5/2000	NAD	Yes	12/6/2000
UPRR - ASB4 - 053FL	Floor	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 054FL	Floor	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 055FL	Floor	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 056FL	Floor	12/5/2000	NAD	Yes	12/6/2000
UPRR - ASB4 - 057FL	Floor	12/5/2000	NAD	Yes	12/6/2000
UPRR - ASB4 - 058FL	Floor	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 059FL	Floor	12/5/2000	NAD	Yes	12/6/2000
UPRR - ASB4 - 060FL	Floor	12/5/2000	<1	Yes	12/6/2000
UPRR - ASB4 - 001N	NW Wall	12/6/2000	NAD	Yes	12/7/2000

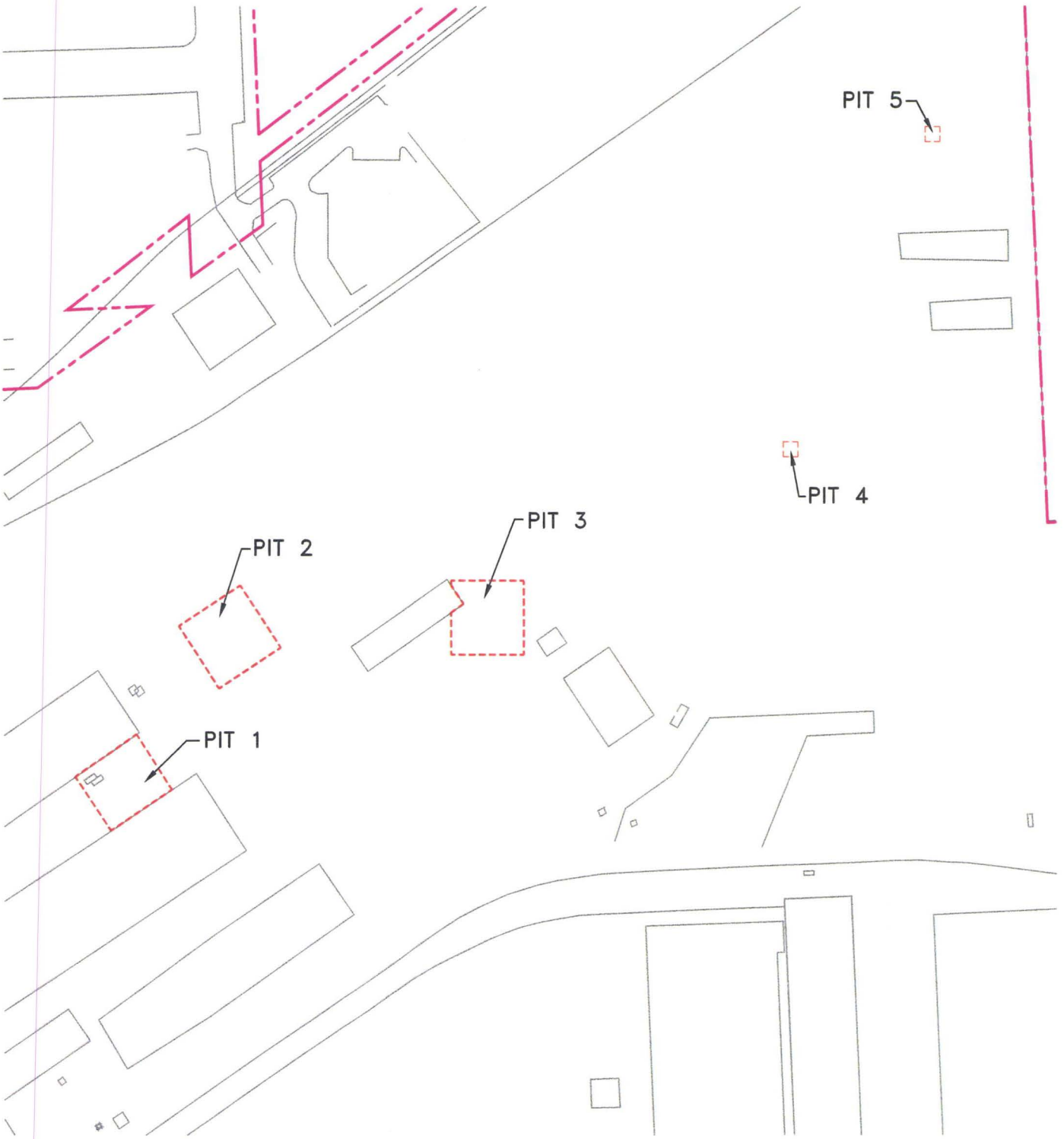
NAD = No Asbestos Detected

TABLE 3-2

ASBESTOS PIT 5
CONFIRMATION SAMPLE RESULTS

Identification Number	Sample Location	Date Collected	% Asbestos	Clearance	Clearance Date
UPRR - ASB5 - 001	Middle Floor	6/20/2000	<1	Yes	6/21/2000
UPRR - ASB5 - 002	North Wall	6/20/2000	<1	Yes	6/21/2000
UPRR - ASB5 - 003	East Wall	6/20/2000	NAD	Yes	6/21/2000
UPRR - ASB5 - 004	South Wall	6/20/2000	NAD	Yes	6/21/2000
UPRR - ASB5 - 005	West Wall	6/20/2000	NAD	Yes	6/21/2000

NAD = No Asbestos Detected



200 100 0 200

SCALE IN FEET

LEGEND

PROPERTY LINE

LIMITS OF EXCAVATION (0–1 FEET)

LIMITS OF EXCAVATION (1.5–3 FEET)

SLABS

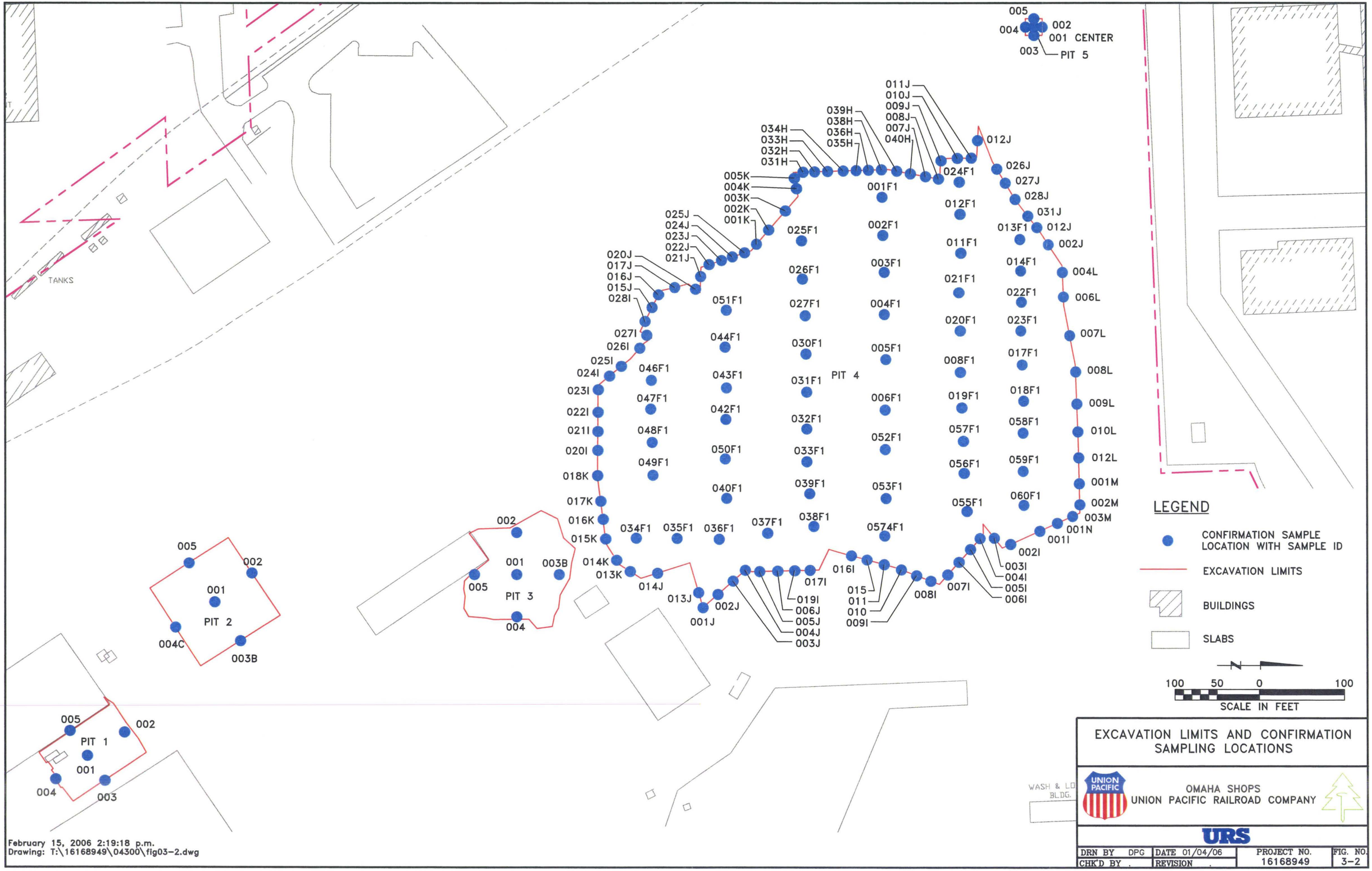
ASBESTOS IMPACTED SOIL AREAS

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/04/06	PROJECT NO. 16168949	FIG. NO. 3-1
CHK'D BY:	DATE:		

February 15, 2006 2:18:31 p.m.
Drawing: T:\16168949\04300\fig03-1.dwg



LEGEND

- CONFIRMATION SAMPLE LOCATION WITH SAMPLE ID
- EXCAVATION LIMITS
- BUILDINGS
- SLABS

100 50 0 100

SCALE IN FEET

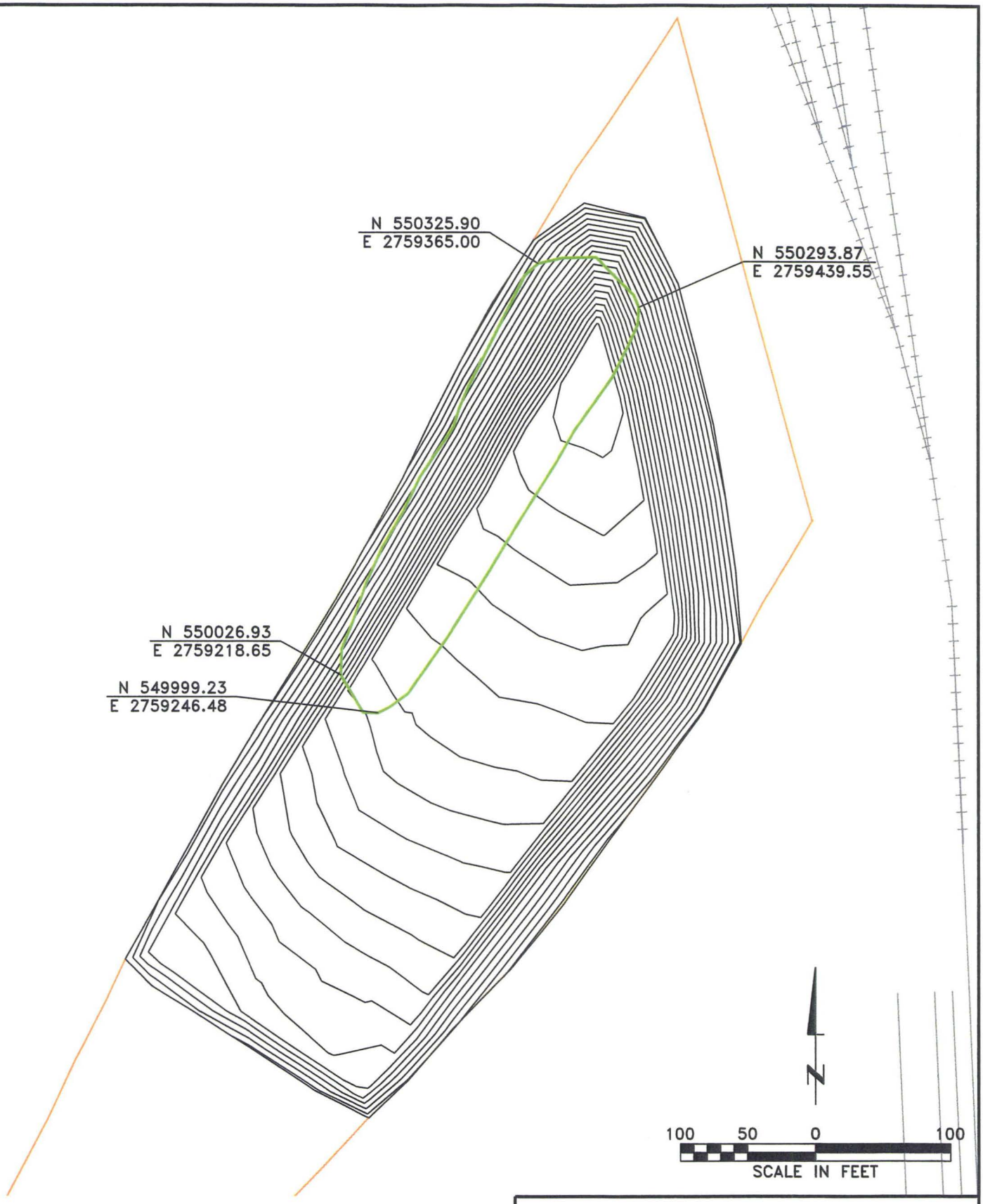
EXCAVATION LIMITS AND CONFIRMATION SAMPLING LOCATIONS

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO.	FIG. NO.
CHK'D BY .	REVISION .	16168949	3-2

February 15, 2006 2:19:18 p.m.
Drawing: T:\16168949\04300\fig03-2.dwg



CUMING STREET EMBANKMENT

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

LEGEND

- RAILROAD TRACK
- TOE OF CUMING ST / ABBOTT DRIVE EMBANKMENT
- SOIL CONTAINING ASBESTOS

February 15, 2006 2:20:06 p.m.
Drawing: T:\16168949\04300\fig03-3.dwg

DRN BY DPG	DATE 01/04/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE:	16168949	3-3

A RCRA IM was completed for the Paint Barrel Pits at the UPRR Omaha Shops. Excavation activities began on June 13, 2000. Excavated material was placed in two separate stockpiles, "assumed hazardous" and "assumed non-hazardous," based on investigative sampling. The "assumed hazardous" stockpile samples were found to be non-hazardous on June 21, 2000. Approximately 7,000 cubic yards of soil were removed and trucked to the Butler County landfill for disposal. Analytical results indicated the Paint Barrel Pits satisfied cleanup objectives on July 12, 2000. The Paint Barrel Pits were backfilled between July 12, 2000 and July 25, 2000 with imported soil. The rationale and recommendations in this document are based on information detailed in the Paint Barrel Pits Interim Measure Completion Report (URS 2001b).

The purpose of the Paint Barrel Pits IM was to remove and dispose of contaminated soils from the Paint Barrel Pits (SWMU 14). The Paint Barrel Pits area was identified from historical facility blueprints in the 1990 Environmental Assessment (HDR 1990). The Paint Barrel Pits were located in an area described as being near the intersection of 12th and Izard Streets. This area has not been used since 1985 (HDR 1990).

4.1 ENVIRONMENTAL ASSESSMENT

A total of six soil borings were completed in the Paint Barrel Pits area during the 1990 Environmental Assessment. The borings were spaced evenly through the apparent center of the old pits, as identified on historical blueprints. An area composite sample was collected for total metals, volatile organic compounds (VOCs), extraction procedure (EP) toxicity, and semivolatile organic compounds (SVOCs) analyses. No VOCs were detected in the soil. However, numerous SVOCs were present at concentrations exceeding industrial media-specific screening levels (MSSLs), including benzo(a)anthracene (25 mg/kg), chrysene (24 mg/kg), benzo(b)fluoranthene (19 mg/kg), and benzo(b)pyrene (20 mg/kg). Antimony and lead were also detected at concentrations of 480 mg/kg and 7,800 mg/kg, respectively, which exceeded industrial MSSLs. The lead EP toxicity concentration was 41 mg/L, which exceeds the 5 mg/L standard.

4.2 FIELD ACTIVITIES

Three test trenches were excavated and two soil borings were drilled at the Paint Barrel Pits in January 1999. Soil samples were collected for chemical analysis from the trenches and borings. The trenching and sampling activities were completed to collect chemical data and to estimate the horizontal and vertical extent of the pits. Only one trench was sampled for chemical analysis due to sloughing soils preventing collection of representative soil samples. The sloughing problems were attributed to the high water table. Chemicals of potential concern were detected at all of the sample locations. The estimated sizes of the Paint Barrel Pits, based on the trenching and soil borings, were:

- West Pit: 30 feet by 120 feet by 7 feet deep
- East Pit: 30 feet by 90 feet by 7 feet deep

The soil/debris material within the pits was excavated down to native soils (about 8 feet below ground surface) using a backhoe. Excavation activities continued about 1 foot into the native soils. The planned lateral limits of the excavation were based on the analytical results for subsurface soil samples collected in January 1999. Initial excavation activities were continued until all of the soil/debris material was removed. The limits of excavation are shown on Figure 4-1.

Excavated material was placed in two separate stockpiles, "assumed hazardous" and "assumed non-hazardous," based on investigative sampling. After stockpiling, a total of eight samples were collected from the stockpiles to determine the regulatory status (i.e., hazardous or non-hazardous) of the excavated material. One grab sample (for VOCs) and four composite samples (for Toxicity Characteristic Leaching Procedure (TCLP) lead) were collected from the "assumed hazardous" stockpile. One grab sample (for VOCs) and two composite samples (for TCLP lead) were collected from the "assumed non-hazardous" stockpile. The stockpile samples did not have VOCs detected above action levels or exhibit TCLP lead concentrations exceeding the 5 mg/kg regulatory level (Table 4-1).

The excavated materials were loaded, manifested, and transported to the Butler County Landfill in accordance with Federal, State, and local laws and regulations for disposal.

Confirmation soil samples were collected from the sidewalls and bottoms of the excavations and analyzed for VOCs and metals. Confirmation soil samples were collected from the sidewalls and bottom using a stainless-steel spoon. The sample material was placed directly into laboratory-cleaned sample containers, labeled, packaged in a cooler with ice, and shipped to Test America Inc. for chemical analysis. Sampling equipment was decontaminated prior to use at each sampling location using an Alconox water wash and clean water rinse. Confirmation soil sample results were compared to the OU1 risk-based concentration for total lead of 1,218 mg/kg. If the results exceeded the risk-based concentration, excavation activities were continued, followed by re-collection of confirmation samples in the newly excavated area.

A total of 10 samples were collected from the west excavation. One composite and one grab sample were collected from each of the four sides and the bottom. A total of 18 samples were collected from the east excavation. Because of the larger size of the east excavation, the number of samples was roughly doubled in comparison to the west excavation. Two composite and two grab samples were collected from all sides and bottom, with the exception of the north face. One composite and one grab sample was collected from the north face because the entire length of the face was not accessible to sampling (Figure 4-2). The composite samples were analyzed for total lead and the grab samples were analyzed for VOCs. None of the samples exceeded action levels (Table 4-2).

After the confirmation samples came back below the action level criteria, the excavation was backfilled with "clean" fill soils brought onto the site. The soils were compacted in the excavation to minimize future settling.

TABLE 4-1

STOCKPILE MATERIAL SAMPLING ANALYTICAL RESULTS SUMMARY

FIELD ID	PBP-HSTK-001			PBP-HSTK-002			PBP-HSTK-003			PBP-HSTK-004			PBP-HSTK-005		
DATE COLLECTED	June 13, 2000			June 13, 2000			June 13, 2000			June 13, 2000			June 13, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)															
Acetone	56.7	50		--			--			--			--		
4-Chlorotoluene	5.6	5		--			--			--			--		
Ethylbenzene	5.9	5		--			--			--			--		
Methylene chloride	305	50		--			--			--			--		
Toluene	5.5	5		--			--			--			--		
Xylenes, Total	28.6	5		--			--			--			--		
METALS (mg/kg)															
Barium	--			0.349	0.1		0.296	0.1		0.407	0.1		0.316	0.1	
Cadmium	--			0.027	0.02		<	0.02	U	<	0.02	U	0.029	0.02	
Lead	--			1.1	0.1		1.1	0.1		0.33	0.1		3.5	0.1	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect

TABLE 4-1

STOCKPILE MATERIAL SAMPLING ANALYTICAL RESULTS SUMMARY

FIELD ID	PBP-NSTK-001			PBP-NSTK-002			PBP-NSTK-003		
DATE COLLECTED	June 13, 2000			June 13, 2000			June 13, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)									
Acetone	82.1	50		--			--		
4-Chlorotoluene	<	5	U	--			--		
Ethylbenzene	<	5	U	--			--		
Methylene chloride	236	50		--			--		
Toluene	<	5	U	--			--		
Xylenes, Total	18.2	5		--			--		
METALS (mg/kg)									
Barium	--			1.4	0.1		1.5	0.1	
Cadmium	--			<	0.02	U	<	0.02	U
Lead	--			<	0.1	U	0.63	0.1	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect

TABLE 4-2

CONFIRMATION SAMPLING ANALYTICAL RESULTS SUMMARY

FIELD ID	UPRR-PBP-E-NF-01			UPRR-PBP-W-NF-01			UPRR-PBP-E-WF-01			UPRR-PBP-W-EF-01			UPRR-PBP-W-BF-01			UPRR-PBP-W-WF-01		
DATE COLLECTED	June 14, 2000			June 14, 2000			June 14, 2000			June 29, 2000			June 29, 2000			June 29, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)																		
Acetone	92	55		67	50		92.9	55		50.3	50		<	50	U	<	50	U
Ethylbenzene	<	5.4	U	<	5	U	6.4	5.6		5.22	5		<	5	U	<	5	U
Methylene chloride	346	54		<	50	U	377	56		<	50	U	<	104	U	<	88	U
Toluene	<	5.4	U	<	5	U	6.2	5.6		42.3	5		<	5	U	<	5	U
Xylenes, Total	<	5.4	U	<	5	U	29	5.6		23	5		<	5	U	<	5	U
TCLP METALS (mg/L)																		
Arsenic	0.168	0.15		0.15	0.15		<	0.15	U	--			--			--		
Barium	0.16	0.1		1.8	0.1		0.303	0.1		--			--			--		
Cadmium	0.12	0.02		<	0.02	U	0.11	0.02		--			--			--		
Chromium	<	0.02	U	<	0.02	U	0.96	0.02		--			--			--		
Lead	<	0.1	U	1.4	0.1		<	0.1	U	--			--			--		
Selenium	<	0.15	U	<	0.15	U	<	0.15	U	--			--			--		
Silver	<	0.02	U	<	0.02	U	<	0.02	U	--			--			--		
METALS (mg/kg)																		
Arsenic	--			--			--			12	1		6.1	1		12	1	
Barium	--			--			--			320	0.5		160	0.5		220	0.5	
Cadmium	--			--			--			3.1	1		5.2	1		1.4	1	
Chromium	--			--			--			19	1		9.9	1		9.4	1	
Lead	--			--			--			720	5		180	5		92	5	
Selenium	--			--			--			<	1	U	<	1	U	<	1	U
Zinc	--			--			--			450	1		530	1		170	1	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 4-2

CONFIRMATION SAMPLING ANALYTICAL RESULTS SUMMARY

FIELD ID	UPRR-PBP-W-SF-01			UPRR-PBP-E-WF-01			UPRR-PBP-E-EF-01			UPRR-PBP-E-SFE-01			UPRR-PBP-E-EFS-01			UPRR-PBP-E-BTE-01		
DATE COLLECTED	June 29, 2000			June 29, 2000			June 29, 2000			July 10, 2000			July 10, 2000			July 10, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)																		
Acetone	<	1,500	U	128	50		<	1,400	U	26	10		<	10	U	43.3	10	
Ethylbenzene	<	150	U	<	5	U	<	140	U	<	2	U	<	2	U	<	2	U
Methylene chloride	<	150	U	258	50		<	1400	U	<	5	U	<	5	U	<	5	U
Toluene	<	150	U	10.6	5		<	140	U	<	2	U	<	2	U	<	2	U
Xylenes, Total	<	150	U	<	5	U	<	140	U	<	2	U	<	2	U	<	2	U
TCLP METALS (mg/L)																		
Arsenic	--			--			--			--			--			--		
Barium	--			--			--			--			--			--		
Cadmium	--			--			--			--			--			--		
Chromium	--			--			--			--			--			--		
Lead	--			--			--			--			--			--		
Selenium	--			--			--			--			--			--		
Silver	--			--			--			--			--			--		
METALS (mg/kg)																		
Arsenic	28	1		40	1		24	1		19.8	1		15.2	1		19.2	0.962	
Barium	160	0.5		800	0.5		480	0.5		NR			NR			NR		
Cadmium	2	1		9.6	1		4.9	1		<	1	U	<	1	U	<	0.962	U
Chromium	24	1		17	1		17	1		23.6	1		23.2	1		15.2	0.962	
Lead	760	5		720	5		1,100	5		645	1		594	1		273	0.962	
Selenium	<	1	U	5.3	1		3.1	1		2	1		1.4	1		<	0.962	U
Zinc	700	1		590	1		680	1		509	10		312	10		148	9.62	

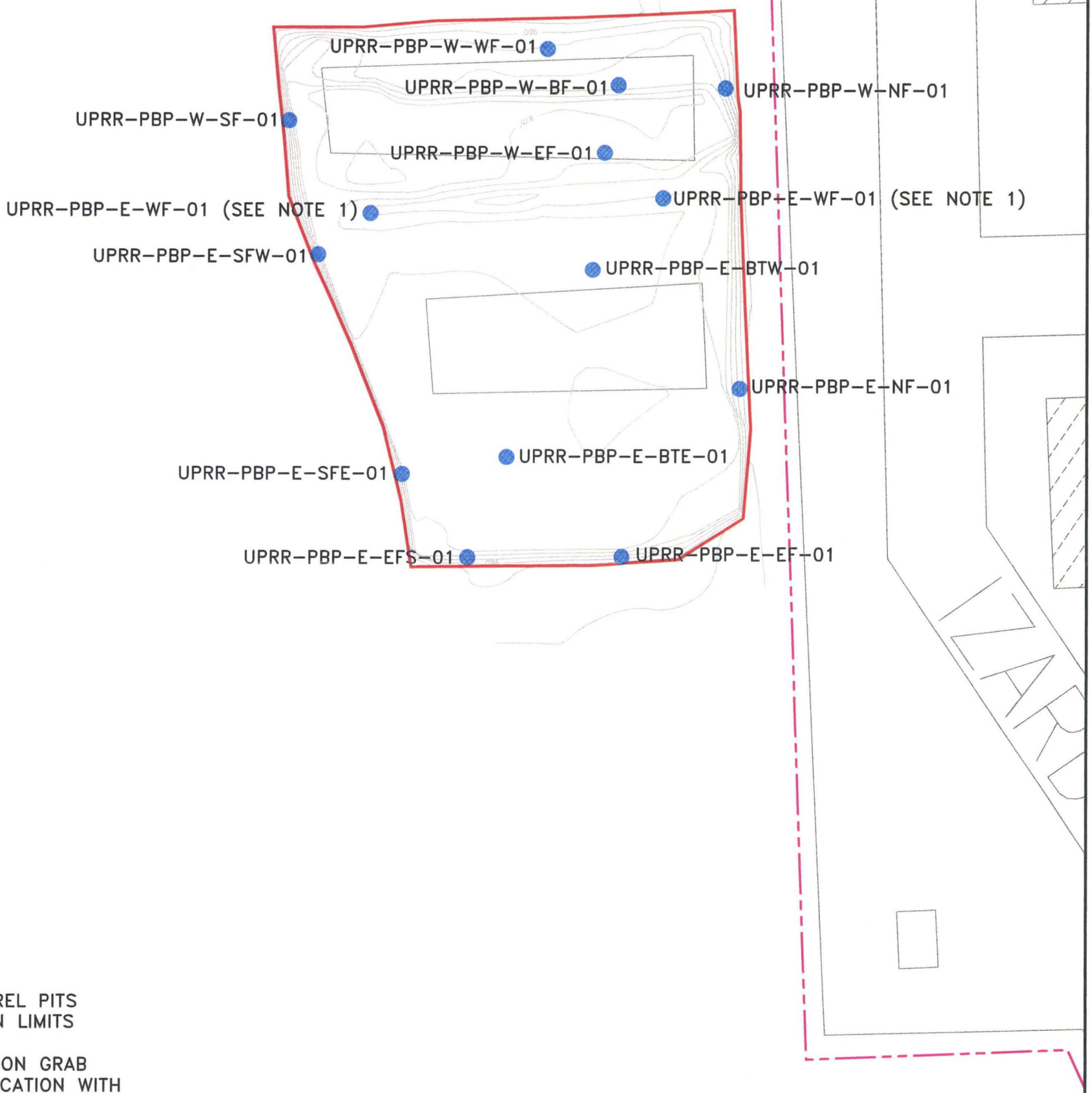
Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 4-2

CONFIRMATION SAMPLING ANALYTICAL RESULTS SUMMARY

FIELD ID	UPRR-PBP-E-BTW-01			UPRR-PBP-E-SFW-01		
DATE COLLECTED	July 10, 2000			July 10, 2000		
	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
Acetone	<	10	U	38.8	10	
Ethylbenzene	<	2	U	<	2	U
Methylene chloride	<	5	U	<	5	U
Toluene	<	2	U	<	2	U
Xylenes, Total	<	2	U	<	2	U
TCLP METALS (mg/L)						
Arsenic	--			--		
Barium	--			--		
Cadmium	--			--		
Chromium	--			--		
Lead	--			--		
Selenium	--			--		
Silver	--			--		
METALS (mg/kg)						
Arsenic	18.5	0.992		13.6	0.973	
Barium	NR			NR		
Cadmium	<	0.992	U	<	0.973	U
Chromium	18.5	0.992		28.8	0.973	
Lead	319	0.992		270	0.973	
Selenium	1.39	0.992		<	0.973	U
Zinc	144	9.92		348	9.73	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported



LEGEND

PAINT BARREL PITS EXCAVATION LIMITS

CONFIRMATION GRAB SAMPLE LOCATION WITH SAMPLE ID

POST EXCAVATION CONTOURS

NOTES:

1. UPRR-PBP-E-WF-01 SAMPLE NAME WAS INADVERTENTLY USED TWICE. THE NORTHERN SAMPLE WAS COLLECTED ON 6/14/00, THE SOUTHERN SAMPLE WAS COLLECTED ON 6/29/00.

N

50 0 50

SCALE IN FEET

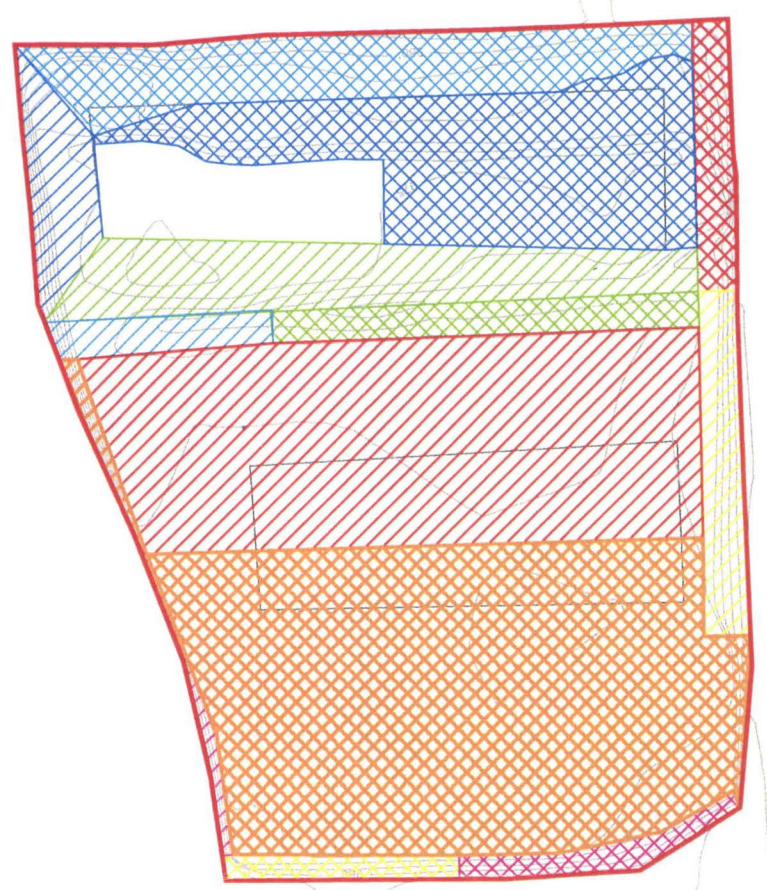
February 15, 2006 2:20:55 p.m.
Drawing: T:\16168949\04300\fig04-1.dwg

PAINT BARREL PITS
EXCAVATION LIMITS AND GRAB SAMPLING

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO. 16168949	FIG. NO. 4-1
CHK'D BY	DATE		



IZARD

LEGEND

- UPRR-PBP-E-EFS-01
- UPRR-PBP-E-BTW-01
- UPRR-PBP-W-NF-01
- UPRR-PBP-E-NF-01
- UPRR-PBP-E-WF-01 (SEE NOTE 1)
- UPRR-PBP-W-EF-01
- UPRR-PBP-W-WF-01
- UPRR-PBP-E-WF-01 (SEE NOTE 1)
- UPRR-PBP-W-BF-01
- UPRR-PBP-W-SF-01
- UPRR-PBP-E-EF-01
- UPRR-PBP-E-SFE-01
- UPRR-PBP-E-BTE-01
- UPRR-PBP-E-SFW-01

PAINT BARREL PITS EXCAVATION LIMITS

POST EXCAVATION CONTOURS

NOTES:

1. UPRR-PBP-E-WF-01 SAMPLE NAME WAS INADVERTENTLY USED TWICE. THE NORTHERN SAMPLE WAS COLLECTED ON 6/14/00, THE SOUTHERN SAMPLE WAS COLLECTED ON 6/29/00.

2. COMPOSITE SAMPLES CONSISTED OF FIVE DISCRETE SAMPLES FROM THE AREA SHOWN.

N

50 0 50

SCALE IN FEET

February 15, 2006 2:21:09 p.m.
Drawing: T:\16168949\04300\fig04-1.dwg

PAINT BARREL PITS
COMPOSITE SAMPLING

UNION PACIFIC

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY DPG	DATE 01/04/06	PROJECT NO.	FIG. NO.
CHK'D BY	DATE	16168949	4-2

A RCRA IM was completed for the Acetylene Sludge Pits at the UPRR Omaha Shops. The City of Omaha's acquisition of OU1 for development of a public-use facility necessitated the need to start interim measures within OU2. A new classification yard was constructed within OU2 requiring the removal of a small portion of the North and South Acetylene Sludge pits to allow for construction of new tracks. These initial removal activities took place in the Summer of 2000. The remaining portion of the North and South Acetylene Sludge Pits were excavated in the Spring of 2002. The rationale and recommendations in this document are based on information detailed in the Acetylene Sludge Pits Interim Measure Completion Report (URS 2002).

The purpose of the Acetylene Sludge Pits IM was to remove and dispose of contaminated soils from the Acetylene Sludge Pits (SWMU 20). The North and South Acetylene Sludge Pits are located north of the former Grace Street Tank and Pumphouse (AOC 13) at the north end of the Omaha Shops facility. Disposal of a "white substance, possibly a waste product" was identified in a 1941 aerial photograph in the locations now occupied by the North and South Acetylene Sludge Pits. These areas of white material are visible in all subsequent aerial photographs of the site. Historical aerial photographs also show areas of standing liquid on and around the areas of white material. No investigations were completed at the North and South Acetylene Sludge Pits prior to 1999.

5.1 1999/2000 FIELD ACTIVITIES

Six test pits were excavated and sampled for chemical analysis in January 1999. Three test pits were dug in each of the two sludge pits (Figure 5-1). The purpose of the trenching and soil sampling activities was to collect chemical data and to estimate the horizontal and vertical extent of the pits. The estimated sizes of the Acetylene Sludge Pits, prior to the initial interim measure in 2000, are listed below:

- North Pit: 160 feet by 180 feet and about 6 feet deep (from the top of the berm).
- South Pit: 90 feet by 110 feet and about 8 feet deep (from the top of the berm).

Twelve soil/sludge samples were collected from the Acetylene Sludge Pits area. Soil samples were collected directly out of the backhoe bucket with a stainless-steel hand auger sampler. During the trenching, soil samples were collected at 2-foot depth intervals and field screened for volatile organic vapors. Six samples in the Acetylene Sludge Pits area were collected from the intervals exhibiting the highest field-screened volatile organic levels, and six were collected from undisturbed native soil underlying the pits. Soil and groundwater samples for chemical analysis were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, TEH, total metals, and TCLP VOCs, SVOCs, and total metals (Table 5-1).

The sludge material was excavated down to native soils (about 6 to 8 feet below the top of the soil berm) using a tracked excavator. Excavation activities continued approximately 1-foot into the native soils. Initial excavation activities continued until all of the sludge material was removed. The limits of excavation are shown on Figure 5-2. Each load of waste material transported off site was properly manifested for disposal.

Confirmation soil samples were collected from the sidewalls and bottom using a stainless-steel spoon. The samples were shipped to Test America Inc. for chemical analysis. Sampling equipment was decontaminated prior to use at each sampling location using an Alconox water wash and clean water rinse. After the confirmation samples came back below the action level criteria, the excavation was backfilled with "clean" fill soils brought onto the site and compacted in the excavation to minimize future settling. If the results exceeded the risk-based concentration, excavation activities were continued, followed by re-collection of confirmation samples in the newly excavated area.

The hazardous acetylene sludge material and any underlying soils excavated during the Summer 2000 activities were transported via railroad gondola cars to Safety Kleen's Deer Park facility in Deer Park, Texas for incineration. A tracked excavator and rubber tire loader loaded the material into the gondola cars. Personnel were positioned at the gondola cars to line and cover them with plastic and to keep the loading area neat.

A total of eleven confirmation samples were collected during the 2000 activities to ensure that the clean-up criteria had been met during excavation (Figure 5-2). Samples were collected and analyzed as follows and the analytical results are presented in Table 5-2:

- A total of 4 samples were collected from the north pit using a hand auger. Grab samples were collected from two locations with one sample being collected between 0-6" and 18-24" at each location. Samples were analyzed for VOCs. None of the samples exceeded TCLP VOC regulatory levels.
- A total of 4 samples were collected from the south pit using a hand auger. Grab samples were collected from three locations with one sample being collected between 0-6" and 18-24" at each location. Samples were analyzed for VOCs. One of the samples exceeded TCLP VOC regulatory levels. Additional soil was removed and the area was resampled. The subsequent confirmation sample did not exceed the TCLP VOC regulatory levels.

The first phase of excavation activities began in August, 2000 and was completed in September, 2000. Approximately 810 cubic yards (923 tons) of material were removed and shipped to the Safety Kleen Deer Park facility in railroad gondola cars in 2000. The material was disposed as a F001 listed waste during this initial removal.

5.2 2002 FIELD ACTIVITIES

As part of the Spring 2002 activities, additional samples were collected and analyzed for waste characterization, disposal profiling, and to further delineate waste boundaries. The two pits were divided into approximately 500-ton areas. Three samples (top half, bottom half, and underlying soils) were collected from each 500 ton area to classify the sampled area as either non-hazardous or hazardous.

Based on the characterization sampling results, the excavated sludge was loaded into either trucks (non-hazardous material) or railroad gondola cars (hazardous material) for transport to the respective disposal facilities. The limits of excavation are shown on Figure 5-2.

The non-hazardous acetylene sludge material and underlying soil was taken via truck to the Butler County Landfill. A tracked excavator and rubber tire loader loaded trucks, with support personnel assisting with liners and ensuring that the loading area was kept neat.

The hazardous acetylene sludge material and any underlying soils was transported via railroad gondola cars to Safety Kleen's Lone Mountain facility in Waynoka, Oklahoma or to Safety Kleen's Deer Park Incinerator facility in Deer Park, Texas for treatment and disposal. A tracked excavator and rubber tire loader loaded the material into the gondola cars. Personnel were positioned at the gondola cars to line and cover them with plastic and to keep the loading area neat.

A total of 20 confirmation samples were collected during the 2002 activities to ensure that the clean-up criteria had been met during the excavation (Figure 5-2). Samples were collected and analyzed as follows and the analytical results are presented in Table 5-3:

- A total of 14 samples were collected from the north pit. Grab samples were collected from the center of each excavation sector (nine sectors total) and one from each sidewall. Samples were analyzed for VOCs. One of the samples exceeded the 2,509 mg/kg action level. Additional soil was removed and the area was resampled. The subsequent confirmation sample did not exceed the 2,509 mg/kg action level.
- A total of 6 samples were collected from the south pit. Grab samples were collected from the center of each excavation sector (four sectors total) and one from the north and east sidewall. Sidewall samples were not collected because theses areas had been previously excavated during the 2000 activities. Samples were analyzed for VOCs. None of the samples exceeded the 2,509 mg/kg action level.

The second phase of excavation activities began in April, 2002 and was completed in May, 2002. Approximately 3,900 tons of material were removed and shipped to the Safety Kleen Deer Park facility for disposal, approximately 810 tons of material were removed and shipped to the Lone Mountain facility for disposal, and approximately 1,640 tons of material were removed and shipped to the Butler County landfill for disposal.

Although prior work in this area had disposed of materials as a F001 waste, further waste characterization determined that the site materials could be characterized as either a D039 waste or as non-hazardous. D039 listed soils which contained less than 60 mg/kg (10 times the Land Ban Regulation Universal Treatment Standard) were disposed of at the Lone Mountain facility. Soils which contained greater than 60 mg/kg and all sludge material were sent to Deer Park for incineration.

5.3 RISK ASSESSMENT

5.3.1 1999 Data

The analytical data collected by URS in 1999 was used to complete a risk assessment and help the interim measures decision-making process. A human health risk assessment was performed

to assess potential adverse health effects associated with current or future exposure to chemicals of potential concern (COPCs) released from the Acetylene Sludge Pits.

The risk assessment evaluated receptors who might be directly exposed to COPCs and included current and future occupational receptors, construction workers, and recreational users/trespassers. The risk assessment showed an unacceptable hazard index (1.65) for construction worker exposures. Exposure to tetrachloroethene was the primary driver of the human health risks for construction workers at the Acetylene Sludge Pits. Additionally, occupational receptor risks were at the upper end of the acceptable levels (1×10^{-4} cancer risk and HI of 1). Tetrachloroethene was the primary contributor. All other estimated risks were within or below the USEPA target risk range of 1×10^{-6} to 1×10^{-4} and an HI of 1.

Based on the 1999 data and the associated risk assessment, the following conclusions were reached:

- Unacceptable adverse health risks are not likely for occupational exposure to acetylene sludge pit soils. However, the hazard index is 1, which is the USEPA's target value. Inhalation of tetrachloroethene was the primary contributor to the HI.
- An RME excess cancer risk of 1×10^{-4} was estimated for exposure to acetylene sludge pit soils by occupational receptors. The cancer risk level is at the upper end of the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}. Inhalation and ingestion of tetrachloroethene were the primary contributors to the cancer risk.
- Unacceptable adverse health effects are not likely for trespassers from exposure to acetylene sludge pit soils. The RME HI is below the USEPA target value of 1.
- Unacceptable excess cancer risks are not likely for trespassers exposed to acetylene sludge pit soils. An RME cancer risk of 9×10^{-6} was estimated for exposure to soil by trespassers. The cancer risk level is within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}.
- Unacceptable adverse health effects have the potential to occur for construction workers exposed to acetylene sludge pit soils. The RME HI was estimated at 1.65. Inhalation and ingestion of tetrachloroethene were the primary contributors.
- Unacceptable excess cancer risks are not likely for construction workers exposed to acetylene sludge pit soils. An RME cancer risk of 5×10^{-6} was estimated for exposure to soil by construction workers. The cancer risk level is within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}.

An action level of 110 mg/kg (Region III Industrial RBC [USEPA 2001]) was used during the excavation and confirmation sampling activities. All confirmation sampling results were below the action level of 110 mg/kg.

5.3.2 2000/2002 Data

The 11 confirmation samples collected by URS in 2000 and the 20 confirmation samples collected by URS in 2002 were used to complete a risk assessment for the residual subsurface chemical concentrations at the Acetylene Sludge Pit. A human health risk assessment was

performed to assess potential adverse health effects associated with current or future exposure to COPCs in subsurface soils associated with the former Acetylene Sludge Pits. The human health risk assessment methodology was consistent with the methodology used in the OU2 RFI (URS 2001) and Interim Measures Completion Report (URS 2002).

The risk assessment considered all receptors who might be directly exposed to COPCs in the subsurface soils including current and future occupational receptors, construction workers, and recreational users/trespassers. Exposure routes are the modes (ingestion, dermal contact, inhalation) by which receptors contact the contaminated media. Occupational receptors, recreators, and trespassers are not expected to be involved with excavation or invasive activities; therefore, exposure to subsurface soil is an incomplete pathway for these receptors. Exposure to subsurface soil represents a potentially complete exposure pathway for construction workers at the site. Construction workers may be exposed to contaminants in subsurface soil by incidental ingestion, dermal contact, or inhalation of particulate or vapor emissions. An action level of 2,509 mg/kg was calculated for tetrachloroethene at the Acetylene Sludge Pit soils.

Risk was calculated using the 2002 confirmation samples and the same methodology as the previous risk assessments. The risk assessment showed that unacceptable adverse health effects are not likely for construction workers since the RME HI was 0.20 for the construction worker scenario, below the USEPA target of 1. Unacceptable excess cancer risks are not likely for the construction worker since the RME cancer risk was 7×10^{-6}. The cancer risk is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}.

5.3.3 Revised Toxicity Factors

Changes have occurred since the previous risk assessments were completed for the OU-2 RFI. These changes are summarized below:

- Only two VOCs were selected as COPCs from the current subsurface soil based on comparison of the maximum detected concentrations with the 2005 USEPA Region III RBCs while 13 VOCs were identified from the 1999 sampling event based on comparison of the maximum detected concentrations with the 2001 USEPA Region III RBCs.
- The maximum detected concentration of PCE remaining in soil after the second phase excavation (668 mg/kg) was significantly lower than the maximum detected soil concentration (5,550 mg/kg) in the 1999 data set (Table 5-4). The maximum concentrations were used to estimate risk in both cases since the 95% UCLs exceeded the maximums due to high standard deviations in the data sets.
- The maximum detected concentration of TCE was higher from the second phase excavation confirmation samples (29 mg/kg) than the maximum detected soil concentration(1.35 mg/kg) in the 1999 data set (Table 5-4. The maximum concentrations were used to estimate risk in both cases since the 95% UCLs exceeded the maximums due to high standard deviations in the data sets.
- Some differences in calculated risks are also due to changes in the chemical-specific toxicity factors (reference dose or slope factor) which are continuously updated by

USEPA. The updated toxicity factors for PCE and TCE were obtained from the 2005 Integrated Risk Information System (IRIS) database.

Chemical	Toxicity Factor	Old Value	New Value
PCE[1]			
	Oral SF $(mg/kg/day)^{-1}$	5.2E-02	5.4E-01
	Inhalation RfD (mg/kg/day)	1.4E-01	8E-02
	Inhalation SF $(mg/kg/day)^{-1}$	2E-03	2E-02
TCE[2]			
	Oral RfD (mg/kg/day)	6E-03	3E-04
	Oral SF $(mg/kg/day)^{-1}$	1.1E-02	4E-01
	Inhalation RfD (mg/kg/day)	None	1E-01
	Inhalation SF $(mg/kg/day)^{-1}$	6E-03	4E-01

[1] Cancer potency factors for PCE have never been available on IRIS and are currently being reviewed by USEPA. Until cancer toxicity factors are incorporated in IRIS, the National Center for Environmental Assessment (NCEA) has agreed that use of the Cal-EPA oral and inhalation slope factors are appropriate and should be used for current and future risk assessments. The previous oral slope factor of 0.052 per mg/kg-day is based on a withdrawn NCEA value and should no longer be used. However, the calculated cancer risk using the more conservative slope factor (0.54 per mg/kg-day) recommended by NCEA did not exceed the USEPA target risk range for this risk assessment.

[2] The USEPA also does not have definitive guidance or policy regarding the toxicity of TCE. As a result, a range of toxicity values, over approximately two orders of magnitude, are currently in use by various federal and state agencies. However, the calculated cancer risk using the most conservative slope factor (0.4 per mg/kg-day) did not exceed the USEPA target risk range for this risk assessment.

The results of the risk assessment using the most conservative toxicity factors showed that unacceptable adverse health effects are not likely for construction workers exposed to Acetylene Sludge Pit soils (Appendix A). The RME HI (0.6) is below the USEPA target value of 1 (Table 5-5). Exposure to PCE and TCE are the drivers of the human health risks for construction workers at the Acetylene Sludge Pits. Approximately 76% of the total Hazard Index was due to inhalation of PCE and TCE. The remaining 24% of the total Hazard Index was due to ingestion of PCE and TCE from soil. Unacceptable excess cancer risks are not likely for construction workers since the estimated RME cancer risk is 7×10^{-6}, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4} (Table 5-5).

Risk was also evaluated for the other scenarios even though exposure to residual contamination in the subsurface soil is not anticipated and is highly unlikely for the occupational worker and trespasser (Appendix A). Based on the 2000/2002 confirmation data and the associated risk assessment using the updated toxicity values, the following conclusions were reached:

- Unacceptable adverse health risks are not likely for occupational exposure to acetylene sludge pit soils. The RME HI is 0.3, which is the below the USEPA target value of 1 (Table 5-6). Inhalation of PCE and TCE are the primary contributors to the HI.

- An RME excess cancer risk of 2×10^{-4} was estimated for exposure to acetylene sludge pit soils by occupational receptors (Table 5-6). The cancer risk level is at the upper end of the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}. Inhalation and ingestion of PCE and TCE are the primary contributors to the cancer risk.

- Unacceptable adverse health effects are not likely for trespassers from exposure to acetylene sludge pit soils. The RME HI is 0.04, which is below the USEPA target value of 1 (Table 5-7). Ingestion of PCE and TCE are the primary contributors to the HI.

- Unacceptable excess cancer risks are not likely for trespassers exposed to acetylene sludge pit soils. A RME cancer risk of 9×10^{-6} was estimated for exposure to soil by trespassers (Table 5-7). The cancer risk level is within the USEPA's target risk range of 1×10^{-6} to 1×10^{-4}. Ingestion of PCE and TCE are the primary contributors to the cancer risk.

Again, it is important to understand that the risk calculations completed for the occupational worker and trespasser assumes exposure to the soils at the bottom of the excavated areas, which would not be likely. The Acetylene Sludge Pit Interim Measure excavations were backfilled with several feet of soil, so unless the occupational worker or trespasser excavate through the clean fill on a routine basis to re-establish the exposure route, the calculated risks are greatly overstated.

TABLE 5-1

1999 ACETYLYNE SLUDGE PIT SOIL SAMPLING RESULTS
UPAS-TP01

FIELD ID		UPAS-TP01-0101			UPAS-TP01-0201		
SAMPLE DEPTH (ft)			3			5	
	Units	Result	RL	Qual	Result	RL	Qual
VOLATILES							
1,2-Dibromoethane	µg/kg	<	1,600	U	9.7	66	
cis-1,2-Dichloroethene	µg/kg	174	160		526	6.6	
Naphthalene	µg/kg	<	780	U	154	33	
Tetrachloroethene	µg/kg	38700	5,000		3,850	160	
Toluene	µg/kg	<	160	U	7.8	6.6	
Trichloroethylene	µg/kg	<	160	U	207	6.6	
Xylenes, Total	µg/kg	<	160	U	18.4	6.6	
Vinyl Chloride	µg/kg	<	460	U	16.7	20	
SEMIVOLATILES							
Benzo(a)anthracene	µg/g	3.1	0.33		<	0.43	U
Benzo(a)pyrene	µg/g	2.3	0.33		<	0.43	U
Benzo(b)fluoranthene	µg/g	2.4	0.33		<	0.43	U
Benzo(k)fluoranthene	µg/g	2.6	0.33		<	0.43	U
Chrysene	µg/g	3	0.33		<	0.43	U
Fluoranthene	µg/g	9.2	0.33		<	0.43	U
Pyrene	µg/g	8.9	0.33		<	0.43	U
PETROLEUM HYDROCARBONS							
Motor Oil	µg/g	300	10	J	<	10	U
TEH	µg/g	300	10	J	<	10	U
METALS							
Arsenic	mg/kg	7.4	1		3.4	1	
Barium	mg/kg	180	0.5		170	0.5	
Chromium	mg/kg	11	1		6.2	1	
Lead	mg/kg	450	5		8.2	5	
Mercury	mg/kg	0.134	0.02		0.021	0.02	
Silver	mg/kg	4.9	1		<	1.3	U
TCLP VOLATILES							
Tetrachloroethene	mg/L	1.3	0.02		0.25	0.02	
TCLP METALS							
Barium	mg/L	2.4	0.1		1.4	0.1	
Lead	mg/L	2.9	0.1		<	0.8	U

Qual - Qualifier
RL - Reporting Limit
J - Estimated
U - Nondetect
µg/kg - microgram per kilogram
µg/g - microgram per gram
mg/kg - miligram per kilogram
mg/L - miligram per liter

TABLE 5-1

1999 ACETYLYNE SLUDGE PIT SOIL SAMPLING RESULTS
UPAS-TP02

FIELD ID		UPAS-TP02-0101			UPAS-TP02-0201		
SAMPLE DEPTH (ft)			2			4	
	Units	Result	RL	Qual	Result	RL	Qual
VOLATILES							
cis-1,2-Dichloroethene	µg/kg	<	250	U	222	5	
Ethylbenzene	µg/kg	<	250	U	5.7	5	
Tetrachloroethene	µg/kg	1,840	1,200		3,950	160	
Toluene	µg/kg	<	250	U	15.7	5	
Trichloroethylene	µg/kg	<	250	U	821	5	
1,2,4-Trimethylbenzene	µg/kg	<	250	U	5.3	5	
Xylenes, Total	µg/kg	<	250	U	27.5	5	
PETROLEUM HYDROCARBONS							
Motor Oil	µg/g	850	10		<	10	U
TEH	µg/g	850	10		<	10	U
METALS							
Arsenic	mg/kg	<	1	U	4.4	1	
Barium	mg/kg	36	0.5		160	0.5	
Chromium	mg/kg	<	13	U	5.5	1	
Lead	mg/kg	88	5		5.9	5	
Mercury	mg/kg	0.567	0.02		<	0.02	U
Selenium	mg/kg	1.1	1		<	1	U
TCLP VOLATILES							
Tetrachloroethene	mg/L	0.04	0.02		0.34	0.02	
Trichloroethylene	mg/L	<	0.02	U	0.06	0.02	
TCLP METALS							
Barium	mg/L	<	0.2	U	1.3	0.1	

Qual - Qualifier
RL - Reporting Limit
J - Estimated
U - Nondetect
µg/kg - microgram per kilogram
µg/g - microgram per gram
mg/kg - miligram per kilogram
mg/L - miligram per liter

TABLE 5-1

1999 ACETYLYNE SLUDGE PIT SOIL SAMPLING RESULTS
UPAS-TP03

FIELD ID		UPAS-TP03-0101			UPAS-TP03-0201		
SAMPLE DEPTH (ft)		2			4		
	Units	Result	RL	Qual	Result	RL	Qual
VOLATILES							
cis-1,2-Dichloroethene	µg/kg	1,360	200	J	1,570	160	
Tetrachloroethene	µg/kg	10,600	7,800		5,780	160	
Trichloroethylene	µg/kg	548	200	J	398	160	
SEMIVOLATILES							
Anthracene	µg/g	<	4.3	U	2.9	0.33	J
Benzo(a)anthracene	µg/g	<	4.3	U	14.2	0.33	J
Benzo(a)pyrene	µg/g	<	4.3	U	15.9	0.33	J
Benzo(b)fluoranthene	µg/g	<	4.3	U	13.8	0.33	J
Benzo(ghi)perylene	µg/g	<	4.3	U	8.1	0.33	J
Benzo(k)fluoranthene	µg/g	<	4.3	U	14.2	0.33	J
Bis(2-ethylhexyl)phthalate	µg/g	7.6	0.33	UJ	<	2.4	U
Chrysene	µg/g	<	4.3	U	14.4	0.33	J
Dibenzo(a,h)anthracene	µg/g	<	4.3	U	3.3	0.33	J
Fluoranthene	µg/g	<	4.3	U	17.9	0.33	J
Indeno(1,2,3-cd)pyrene	µg/g	<	4.3	U	8.3	0.33	J
Phenanthrene	µg/g	<	4.3	U	9.7	0.33	J
Pyrene	µg/g	<	4.3	U	17.3	0.33	J
PCBs							
Aroclor 1260	µg/g	1	0.2		<	0.2	U
PETROLEUM HYDROCARBONS							
Motor Oil	µg/g	11,000	1,000		450	10	
TEH	µg/g	11,000	1,000		450	10	
METALS							
Arsenic	mg/kg	26	1	J	7	1	
Barium	mg/kg	180	0.5		2,300	0.5	
Cadmium	mg/kg	<	9.7	U	36	1	
Chromium	mg/kg	30	1		190	1	
Lead	mg/kg	320	5	J	3,400	5	
Mercury	mg/kg	0.603	0.02		0.408	0.02	
TCLP VOLATILES							
Tetrachloroethene	mg/L	0.19	0.02	J	0.59	0.02	
Trichloroethylene	mg/L	0.04	0.02		0.07	0.02	
TCLP METALS							
Barium	mg/L	1.3	0.1	J	1	0.1	
Lead	mg/L	1.3	0.1	J	<	0.8	U

Qual - Qualifier
RL - Reporting Limit
J - Estimated
U - Nondetect
µg/kg - microgram per kilogram
µg/g - microgram per gram
mg/kg - miligram per kilogram
mg/L - miligram per liter

TABLE 5-1

1999 ACETYLYNE SLUDGE PIT SOIL SAMPLING RESULTS
UPAS-TP04

FIELD ID		UPAS-TP04-0101			UPAS-TP04-0201		
SAMPLE DEPTH (ft)			3			8	
	Units	Result	RL	Qual	Result	RL	Qual
VOLATILES							
1,2-Dichlorobenzene	µg/kg	378	240		16.8	5	
cis-1,2-Dichloroethene	µg/kg	<	240	U	89.1	5	
trans-1,2-Dichloroethene	µg/kg	<	240	U	33.3	5	
Ethylbenzene	µg/kg	6,990	240		202	5	
Tetrachloroethene	µg/kg	1,450,000	98,000		<	160	U
Toluene	µg/kg	<	240	U	14.6	5	
Trichloroethylene	µg/kg	440	240	J	<	5	U
1,2,4-Trimethylbenzene	µg/kg	396	240		11.3	5	
Vinyl Chloride	µg/kg	<	700	U	311	15	
Xylenes, Total	µg/kg	39,900	240		1,200	5	
SEMIVOLATILES							
1,2-Dichlorobenzene	µg/g	1.2	0.33		<	0.43	U
Phenanthrene	µg/g	0.72	0.33		<	0.43	U
PCBs							
Aroclor 1260	µg/g	0.31	0.1	J	<	0.02	U
PETROLEUM HYDROCARBONS							
Motor Oil	µg/g	290	10	J	<	10	U
TEH	µg/g	290	10	J	<	10	U
METALS							
Arsenic	mg/kg	<	1	U	1.8	1	
Barium	mg/kg	<	0.62	U	220	0.5	
Chromium	mg/kg	<	12	U	6.1	1	
Lead	mg/kg	38	5		6.3	5	
Mercury	mg/kg	<	0.02	U	0.026	0.02	
TCLP VOLATILES							
Tetrachloroethene	mg/L	22.6	0.02		<	0.1	U
Trichloroethylene	mg/L	0.03	0.02		<	0.02	U
TCLP METALS							
Barium	mg/L	<	0.2	U	1.2	0.1	

Qual - Qualifier
RL - Reporting Limit
J - Estimated
U - Nondetect
µg/kg - microgram per kilogram
µg/g - microgram per gram
mg/kg - miligram per kilogram
mg/L - miligrams per liter

TABLE 5-1

1999 ACETYLYNE SLUDGE PIT SOIL SAMPLING RESULTS
UPAS-TP05

FIELD ID		UPAS-TP05-0101			UPAS-TP05-0201		
SAMPLE DEPTH (ft)			5			8	
	Units	Result	RL	Qual	Result	RL	Qual
VOLATILES							
Benzene	µg/kg	<	130	U	9.7	5.8	J
1,2-Dichlorobenzene	µg/kg	1,190	130		<	2.8	U
1,1-Dichloroethene	µg/kg	<	130	U	8.1	5.8	J
cis-1,2-Dichloroethene	µg/kg	564	130		2,770	160	J
trans-1,2-Dichloroethene	µg/kg	<	130	U	130	5.8	J
Ethylbenzene	µg/kg	2900	130		15.2	5.8	J
Tetrachloroethene	µg/kg	1,020,000	89,000		2,440	160	J
Toluene	µg/kg	<	130	U	8.1	5.8	J
Trichloroethylene	µg/kg	1,350	130	J	12.7	5.8	J
1,2,4-Trimethylbenzene	µg/kg	253	130		<	29	U
Vinyl Chloride	µg/kg	<	390	U	266	18	J
Xylenes, Total	µg/kg	15,500	130		86.8	5.8	
SEMIVOLATILES							
Anthracene	µg/g	0.66	0.33		<	0.43	U
Benzo(a)anthracene	µg/g	1.7	0.33		<	0.43	U
Benzo(a)pyrene	µg/g	1.5	0.33		<	0.43	U
Benzo(b)fluoranthene	µg/g	1.5	0.33		<	0.43	U
Benzo(k)fluoranthene	µg/g	1.3	0.33		<	0.43	U
Chrysene	µg/g	1.7	0.33		<	0.43	U
1,2-Dichlorobenzene	µg/g	5.4	0.33		<	0.43	U
Fluoranthene	µg/g	4.6	0.33		<	0.43	U
2-Methylnaphthalene	µg/g	1.2	0.33		<	0.43	U
Phenanthrene	µg/g	3.7	0.33		<	0.43	U
Pyrene	µg/g	4.2	0.33		<	0.43	U
PCBs							
Aroclor 1260	µg/g	0.067	0.02		<	0.02	U
PETROLEUM HYDROCARBONS							
Motor Oil	µg/g	350	10	J	<	10	U
TEH	µg/g	350	10	J	<	10	U
METALS							
Arsenic	mg/kg	1.5	1		5	1	
Barium	mg/kg	60	0.5		180	0.5	
Chromium	mg/kg	<	12	U	7.8	1	
Lead	mg/kg	180	5		8	5	
Mercury	mg/kg	0.045	0.02		0.025	0.02	
TCLP VOLATILES							
Tetrachloroethene	mg/L	75.5	0.02	J	0.86	0.02	
Trichloroethylene	mg/L	0.09	0.02		<	0.02	U
TCLP METALS							
Barium	mg/L	<	0.2	U	1.2	0.1	

Qual - Qualifier
RL - Reporting Limit
J - Estimated
U - Nondetect
µg/kg - microgram per kilogram
µg/g - microgram per gram
mg/kg - miligram per kilogram
mg/L - miligram per liter

TABLE 5-1

1999 ACETYLYNE SLUDGE PIT SOIL SAMPLING RESULTS
UPAS-TP06

FIELD ID		UPAS-TP06-0101			UPAS-TP06-0201		
SAMPLE DEPTH (ft)		3			8		
	Units	Result	RL	Qual	Result	RL	Qual
VOLATILES							
1,2-Dichlorobenzene	µg/kg	24,000	20,000		<	160	U
cis-1,2-Dichloroethene	µg/kg	<	20,000	U	10900	160	
trans-1,2-Dichloroethene	µg/kg	<	20,000	U	227	160	
Ethylbenzene	µg/kg	119,000	20,000		<	160	U
Tetrachloroethene	µg/kg	5,550,000	20,000		18,200	160	
1,1,1-Trichloroethane	µg/kg	26,600	20,000		<	160	U
Trichloroethylene	µg/kg	<	20,000	U	251	160	
Vinyl Chloride	µg/kg	<	59,000	U	819	480	
Xylenes, Total	µg/kg	634,000	20,000		<	160	U
SEMIVOLATILES							
1,2-Dichlorobenzene	µg/g	<	3.2	U	1.2	0.33	J
Fluoranthene	µg/g	<	3.2	U	1.2	0.33	J
2-Methylnaphthalene	µg/g	4.1	0.33	J	<	0.43	U
Phenanthrene	µg/g	5.6	0.33	J	1.2	0.33	J
Pyrene	µg/g	<	3.2	U	0.97	0.33	J
PCBs							
Aroclor 1260	µg/g	0.062	0.1	J	<	0.02	U
PETROLEUM HYDROCARBONS							
Motor Oil	µg/g	13000	1000	J	130	10	J
TEH	µg/g	13000	1000	J	130	10	J
METALS							
Arsenic	mg/kg	2.1	1		7.1	1	
Barium	mg/kg	17	0.5		180	0.5	
Cadmium	mg/kg	<	9.9	U	1.1	1	
Chromium	mg/kg	<	13	U	10	1	
Lead	mg/kg	160	5		120	5	
Mercury	mg/kg	0.033	0.02		0.102	0.02	
TCLP VOLATILES							
Tetrachloroethene	mg/L	27.3	0.02		3	0.02	
Trichloroethylene	mg/L	<	0.02	U	0.03	0.02	
TCLP METALS							
Barium	mg/L	0.23	0.1		1.3	0.1	

Qual - Qualifier
RL - Reporting Limit
J - Estimated
U - Nondetect
µg/kg - microgram per kilogram
µg/g - microgram per gram
mg/kg - miligram per kilogram
mg/L - miligram per liter

TABLE 5-2

2000
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID DATE COLLECTED	UPRR-ASP1-CONF-001 June 14, 2000			UPRR-ASP1-CONF-002 June 14, 2000			UPRR-ASP2-CONF-001 June 14, 2000			UPRR-ASP2-CONF-002 June 29, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Bromomethane							4.6	2				
Chlorobenzene												
1,2-Dichlorobenzene												
cis-1,2-Dichloroethene				151	2		4.7	2		24,000	2	
trans-1,2-Dichloroethene												
Ethylbenzene										8.9	2	
Methylene chloride												
Napthalene	5.1	5										
Tetrachloroethene	147	2		33,150	1		209	2		106	2	
Trichloroethene				39.1	2		3.8	2		29,000	2	
1,2,4-Trimethylbenzene												
1,3,5-Trimethylbenzene												
Vinyl chloride												
Xylenes, Total												

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-2

2000
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPRR-ASP3-CONF-001			UPRR-ASP3-CONF-002			UPRR-ASP4-CONF-001			UPRR-ASP4-CONF-002		
DATE COLLECTED	June 29, 2000			June 29, 2000			June 29, 2000			June 29, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Bromomethane												
Chlorobenzene												
1,2-Dichlorobenzene				32.7	2					4.6	2	J
cis-1,2-Dichloroethene	180	2		630	2		0.1	2		1,180	10	
trans-1,2-Dichloroethene	3.3	2		8.7	2					4.8	2	
Ethylbenzene				73.2	2					13.1	2	
Methylene chloride												
Napthalene												
Tetrachloroethene	5,000	100		3,260	200		3.2	100		78.1	2	
Trichloroethene	0.1	2		1,160	200		69.2	2		12.9	2	
1,2,4-Trimethylbenzene				7.1	2							
1,3,5-Trimethylbenzene				4.0	2							
Vinyl chloride				16.3	2					124	2	
Xylenes, Total				505	2					61.7	2	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-2

2000
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPRR-ASP5-CONF-001			UPRR-ASP5-CONF-002			UPRR-ASP5-WNF-02B		
DATE COLLECTED	June 29, 2000			July 10, 2000			August 14, 2000		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)									
Bromomethane									
Chlorobenzene							3.7	2	
1,2-Dichlorobenzene	10.8	2	J	3.6	2	J			
cis-1,2-Dichloroethene	650	2		110	2		354	2	
trans-1,2-Dichloroethene	9.1	2					44.2	2	
Ethylbenzene	12.3	2		32.2	2				
Methylene chloride									
Napthalene									
Tetrachloroethene	261,000	10		25,750	1,000		24.7	2	
Trichloroethene	69.5	0		96.0	2		22.6	2	
1,2,4-Trimethylbenzene									
1,3,5-Trimethylbenzene									
Vinyl chloride				24.5	2		157	1	
Xylenes, Total	57.9	2		138	2		9.3	2	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-3

2002
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPASP-CONF-ASE-001			UPASP-CONF-BNE-001			UPASP-CONF-BNW-001			UPASP-CONF-BSE-001		
DATE COLLECTED	May 2, 2002			May 2, 2002			May 6, 2002			May 6, 2002		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Acetone	81.8	65					130	69				
Benzene	14.6	6.5										
n-Butylbenzene												
sec-Butylbenzene												
tert-Butylbenzene												
Carbon tetrachloride												
Chlorobenzene	22.1	6.5										
1,2-Dichlorobenzene	33.4	6.5								22.6	6.5	
1,4-Dichlorobenzene	11	6.5										
1,1-Dichloroethene												
cis-1,2-Dichloroethene	15,300	155		2,400	6.2		1,080	165		4,955	156	
trans-1,2-Dichloroethene	208	155					95.6	6.9		50.3	6.5	
Ethylbenzene	707	6.5										
Isopropylbenzene												
p-Isopropyltoluene	8.8	6.5										
Methylene chloride	383	6.5		68	62		73	69		256	65	
Napthalene	10.3	802										
n-Propylbenzene	16.2	6.5										
Tetrachloroethene	668,000	3,240								494	156	
Toluene	51.5	6.5										
1,1,2-Trichloroethane												
Trichloroethene	2,670	155					17	6.9		51	6.5	
1,2,4-Trimethylbenzene	251	6.5										
1,3,5-Trimethylbenzene	104	6.5										
Vinyl chloride	606	19		36	18.0		130	21		194	20	
Xylenes, Total	1,980	479										

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-3

2002
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPASP-CONF-BSW-001			UPASP-WALL-BE-001			UPASP-WALL-BN-001			UPASP-WALL-AE-001		
DATE COLLECTED	May 6, 2002			May 7, 2002			May 7, 2002			May 7, 2002		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Acetone	110	64		151	67.0							
Benzene												
n-Butylbenzene												
sec-Butylbenzene												
tert-Butylbenzene												
Carbon tetrachloride												
Chlorobenzene												
1,2-Dichlorobenzene	15.6	6.4		856	6.7							
1,4-Dichlorobenzene				85	6.7							
1,1-Dichloroethene												
cis-1,2-Dichloroethene	2,980	6.4		1,820	161		2,130	166		6,010	158	
trans-1,2-Dichloroethene	36	6.4		34.2	6.7		36.6	6.9		102	6.6	
Ethylbenzene	13	6.4		834	6.7					7.5	6.6	
Isopropylbenzene				15.7	6.7							
p-Isopropyltoluene												
Methylene chloride	77	64		110	67		87	69		92	66	
Napthalene												
n-Propylbenzene				29.6	6.7							
Tetrachloroethene	2,180	6.4		75,500	161		4,740	166		11,000	158	
Toluene	9.9	6.4		22.1	6.7							
1,1,2-Trichloroethane	131	6.4										
Trichloroethene	18.2	6.4		784	6.7		1,040	6.9		1,660	6.6	
1,2,4-Trimethylbenzene				133	6.7							
1,3,5-Trimethylbenzene				51.1	6.7							
Vinyl chloride	227	19		100	20					34	20	
Xylenes, Total	84	19		5,130	20							

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-3

2002
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPASP-CONF-ACE-001			UPASP-CONF-AC-001			UPASP-CONF-ASC-001			UPASP-CONF-ASW-001		
DATE COLLECTED	May 7, 2002			May 9, 2002			May 13, 2002			May 13, 2002		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Acetone							73	63		110	67	
Benzene	56.4	6.4		13	6.9							
n-Butylbenzene												
sec-Butylbenzene												
tert-Butylbenzene												
Carbon tetrachloride				25.2	6.9							
Chlorobenzene												
1,2-Dichlorobenzene												
1,4-Dichlorobenzene												
1,1-Dichloroethene												
cis-1,2-Dichloroethene	957	154		3,059	165		539.0	6.3		478	6.7	
trans-1,2-Dichloroethene	60	6.4		83.1	6.9							
Ethylbenzene												
Isopropylbenzene												
p-Isopropyltoluene												
Methylene chloride	67	64		83	69							
Napthalene												
n-Propylbenzene												
Tetrachloroethene	5,950	154		2,025	165		3,500	151		5,040	162	
Toluene							37.1	6.3				
1,1,2-Trichloroethane												
Trichloroethene	591	154		2,962	165		77.1	6.3		143	6.7	
1,2,4-Trimethylbenzene												
1,3,5-Trimethylbenzene												
Vinyl chloride	120	19		349	21					110	20	
Xylenes, Total							34	19		40	20	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-3

2002
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPASP-CONF-ACW-001			UPASP-CONF-ANW-001			UPASP-CONF-ANC-001			UPASP-CONF-ASE-002		
DATE COLLECTED	May 13, 2002			May 13, 2002			May 13, 2002			May 13, 2002		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Acetone	110	64		110	64		76	74				
Benzene												
n-Butylbenzene	37.5	6.4		25.5	6.4							
sec-Butylbenzene	18.4	6.4		11	6.4							
tert-Butylbenzene	27.4	6.4		24.4	6.4							
Carbon tetrachloride												
Chlorobenzene												
1,2-Dichlorobenzene												
1,4-Dichlorobenzene												
1,1-Dichloroethene												
cis-1,2-Dichloroethene	833.0	19		420	6.4		10,500	178		45,020	3,750	
trans-1,2-Dichloroethene							153	7.4		428	155	
Ethylbenzene	28.4	6.4		14.3	6.4		14	7.4				
Isopropylbenzene												
p-Isopropyltoluene												
Methylene chloride	75.0	64		110	64							
Napthalene												
n-Propylbenzene	10	6.4										
Tetrachloroethene	48,000	153		24,800	155							
Toluene							12	7.4				
1,1,2-Trichloroethane												
Trichloroethene	445	6.4		259	6.4							
1,2,4-Trimethylbenzene	112	6.4		76.4	6.4							
1,3,5-Trimethylbenzene	29.6	6.4		17.9	6.4							
Vinyl chloride	28	19					2,360	22		620	466	
Xylenes, Total	176	19		94	19							

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-3

2002
CONFIRMATION SAMPLE ANALYTICAL RESULTS SUMMARY

FIELD ID	UPASP-WALL-AW-001			UPASP-WALL-AN-001			UPASP-WALL-AS-001			UPASP-CONF-ANE-001		
DATE COLLECTED	May 17, 2002			May 17, 2002			May 17, 2002			May 17, 2002		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
VOLATILE ORGANIC COMPOUNDS (µg/kg)												
Acetone				78	65							
Benzene										23.4	6.6	
n-Butylbenzene												
sec-Butylbenzene												
tert-Butylbenzene												
Carbon tetrachloride												
Chlorobenzene										56.5	6.6	
1,2-Dichlorobenzene										145	6.6	
1,4-Dichlorobenzene												
1,1-Dichloroethene										13	6.6	
cis-1,2-Dichloroethene	74.6	6		168	6.5		620	6.2		4,900	158	
trans-1,2-Dichloroethene							16.6	6.2		98.4	6.6	
Ethylbenzene												
Isopropylbenzene												
p-Isopropyltoluene												
Methylene chloride												
Napthalene												
n-Propylbenzene												
Tetrachloroethene	6,350	145		1,410	6.5		14,870	150		205	6.6	
Toluene										8.5	6.6	
1,1,2-Trichloroethane												
Trichloroethene	80.7	6		96.9	6.5		811	6.2		12	6.6	
1,2,4-Trimethylbenzene												
1,3,5-Trimethylbenzene												
Vinyl chloride										635	20	
Xylenes, Total										49	20	

Notes:
-- = Not Analyzed
RL = Reporting Limit
Qual = Qualifier
U = Nondetect
NR = Not Reported

TABLE 5-4

COMPARISON OF MAXIMUM DETECTED CONFIRMATION SOIL SAMPLE CONCENTRATIONS
ACETYLENE SLUDGE PITS

Chemical	Detection Frequency	Maximum Detection (ug/kg)	Maximum Detection (mg/kg)	Region III Industrial Soil[1] RBC (mg/kg)	Frequency Exceeding
VOLATILES					
1,1,2-Trichloroethane	1/31	1.31E+02	1.31E-01	7.2E+00	0/31
1,2,4-Trimethylbenzene	5/31	2.51E+02	2.51E-01	5.1E+04	0/31
1,3,5-Trimethylbenzene	5/31	1.04E+02	1.04E-01	5.1E+04	0/31
1,2-Dichlorobenzene	3/31	8.56E+02	8.56E-01	9.2E+04	0/31
1,4-Dichlorobenzene	1/31	8.50E+01	8.50E-02	1.2E+02	0/31
1,1-Dichloroethane	1/31	1.30E+01	1.30E-02	2.0E+05	0/31
2-Chlorotoluene	1/5	2.17E+00	2.17E-03	2.0E+04	0/31
4-Chlorotoluene	3/5	8.88E+01	8.88E-02	2.0E+04	0/31
Acetone	11/31	1.51E+02	1.51E-01	9.2E+05	0/31
Benzene	5/31	5.64E+01	5.64E-02	5.2E+01	0/31
Bromomethane	1/31	4.60E+00	4.60E-03	1.4E+03	0/31
n-Butylbenzene	2/31	3.75E+01	3.75E-02	1.0E+05	0/31
sec-Butylbenzene	2/31	1.84E+01	1.84E-02	1.0E+05	0/31
tert-Butylbenzene	2/31	2.74E+01	2.74E-02	1.0E+05	0/31
Carbon tetrachloride	1/31	2.52E+01	2.52E-02	2.2E+01	0/31
Chlorobenzene	3/31	5.65E+01	5.65E-02	2.0E+04	0/31
cis-1,2-dichloroethene	30/31	4.50E+04	4.50E+01	1.0E+04	0/31
trans-1,2-dichloroethene	19/31	4.28E+02	4.28E-01	2.0E+04	0/31
Ethylbenzene	11/31	8.34E+02	8.34E-01	1.0E+05	0/31
Isopropylbenzene	1/31	1.57E+01	1.57E-02	1.0E+05	0/31
P-isopropyltoluene	1/31	8.80E+00	8.80E-03	2.0E+05	0/31
Methylene Chloride	13/31	3.83E+02	3.83E-01	3.8E+02	0/31
Naphthalene	2/31	8.02E+02	8.02E-01	2.0E+04	0/31
n-Propylbenzene	3/31	2.96E+01	2.96E-02	1.0E+05	0/31
Tetrachloroethene	27/31	6.68E+05	6.68E+02	5.3E+00	**25/31**
Toluene	6/31	5.15E+01	5.15E-02	2.0E+05	0/31
Trichloroethene	27/31	2.90E+04	2.90E+01	7.2E+00	**25/31**
Vinyl chloride	18/31	2.36E+03	2.36E+00	4.0E+00	0/31
Xylenes, Total	13/31	5.13E+03	5.13E+00	2.0E+05	0/31

[1] USEPA Region III Risk-Based Concentrations for Industrial Soil. Printed from website *www.epa.gov/reg3hwmd/risk/riskmenu.htm*. April, 2005

TABLE 5-5

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH CONSTRUCTION WORKER EXPOSURE TO ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)

	AVERAGE EXPOSURE		RME	
	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX
		ON-SITE CONSTRUCTION WORKER		
INGESTION	5.41E-08	3.52E-03	2.50E-06	1.48E-01
DERMAL	1.94E-10	1.33E-04	5.23E-08	3.09E-03
INHALATION	1.57E-06	2.03E-01	4.83E-06	4.69E-01
TOTAL	1.63E-06	2.07E-01	7.38E-06	6.20E-01

TABLE 5-6

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH OCCUPATIONAL EXPOSURE TO ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)

	AVERAGE EXPOSURE		RME	
	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX
		ON-SITE OCCUPATIONAL RECEPTOR		
INGESTION	0.00E+00	3.95E-04	6.51E-05	8.00E-02
DERMAL	0.00E+00	2.35E-05	8.22E-07	1.01E-03
INHALATION	2.34E-06	1.13E-02	1.68E-04	2.14E-01
TOTAL	2.34E-06	1.2E-02	2.34E-04	3.0E-01

TABLE 5-7

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH TRESPASSER EXPOSURE TO ACETYLENE SLUDGE PIT SOIL (POST-EXCAVATION)

	AVERAGE EXPOSURE		RME	
	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX
		ON-SITE TRESPASSER		
INGESTION	1.44E-07	4.94E-04	6.66E-06	2.56E-02
DERMAL	1.75E-08	6.01E-05	9.49E-07	3.64E-03
INHALATION	2.58E-07	1.03E-03	1.72E-06	6.85E-03
TOTAL	4.20E-07	1.58E-03	9.33E-06	3.61E-02

LEGEND

- TEST PIT LOCATION
- RAILROAD TRACK
- PROPERTY LINE
- BUILDING SLAB
- STRUCTURES
- APPROXIMATE EXTENT OF ACETYLENE SLUDGE PITS PRIOR TO INITIAL INTERIM MEASURES WORK
- EXTENT OF REMAINING ACETYLENE SLUDGE PIT MATERIAL
- HIGH TENSION ELECTRICAL TOWER

N

60 30 0 60

SCALE IN FEET

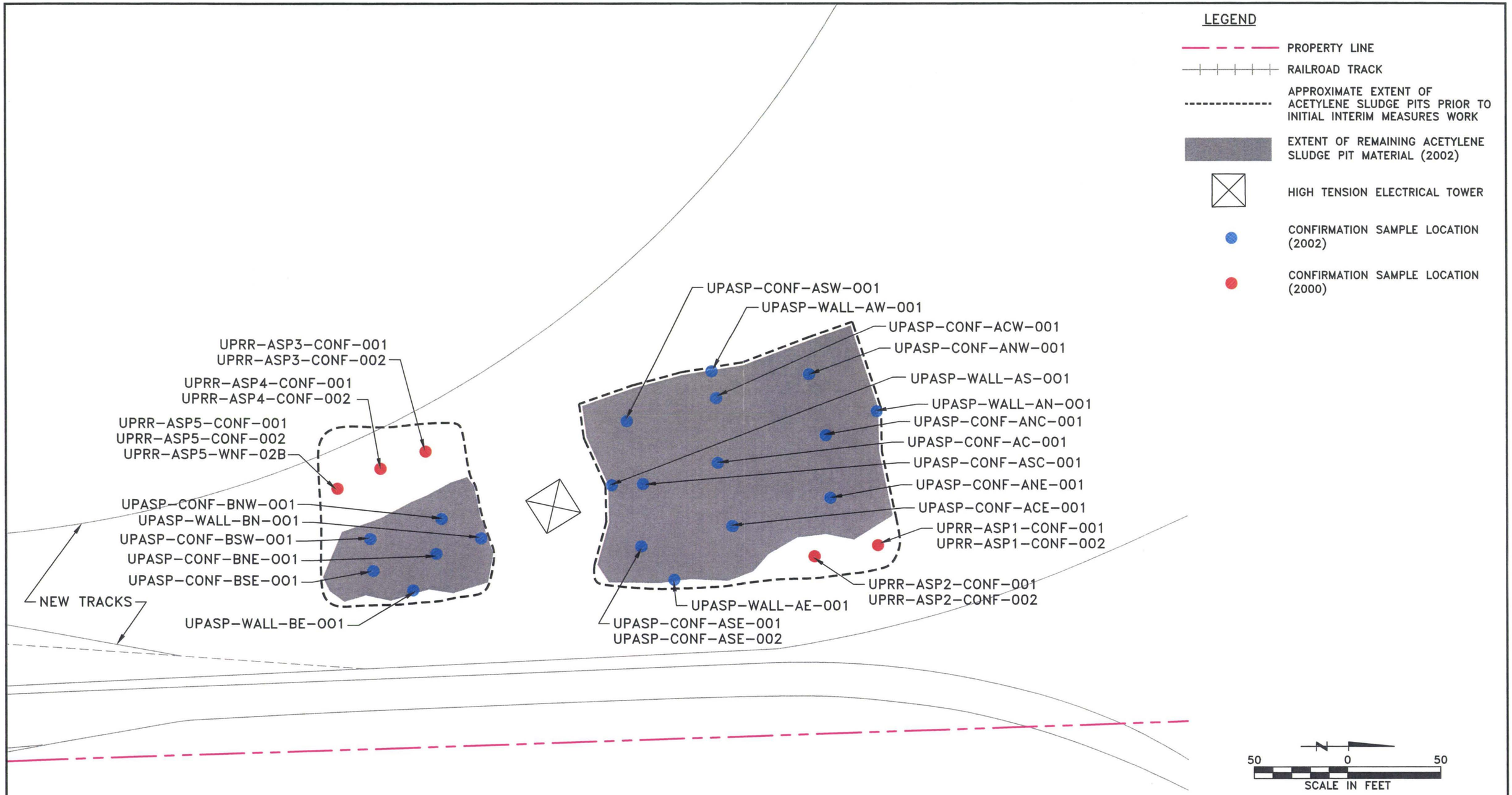
ACETYLENE SLUDGE PITS SITE PLAN

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/04/06	PROJECT NO. 16168949	FIG. NO. 5-1
CHK'D BY:	DATE:		

February 15, 2006 2:22:04 p.m.
Drawing: T:\16168949\04300\fig05-1.dwg



ACETYLENE SLUDGE PITS EXCAVATION LIMITS AND CONFIRMATION SAMPLING

OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

URS

DRN BY: DPG	DATE: 01/04/06	PROJECT NO. 16168949	FIG. NO. 5-2
CHK'D BY:	DATE:		

February 15, 2006 2:27:45 p.m.
Drawing: T:\16168949\04300\fig05-2.dwg

SECTIONSIX Identification and Screening of Corrective Measure Alternatives

This section of this CMS identifies corrective measure alternatives that may be used to achieve the corrective action objectives established for OU2. The corrective measure alternatives are screened to eliminate those technologies that may not prove feasible to implement, that rely on technologies unlikely to perform satisfactorily, or that would not achieve the corrective action objectives within a reasonable period of time. However, there are no excess carcinogenic risks or hazard indices under the commercial/industrial exposure scenarios, and therefore no need to evaluate potential constructible corrective measures at OU2 under commercial/industrial uses. UPRR has taken the position that land sales within OU2 will not allow for residential land use.

The identification and screening process followed in this CMS addresses a range of applicable corrective measures alternatives and presents relevant information required to select a suitable approach for remediation. Selection of corrective measures alternatives proceeds in a series of steps designed to reduce the range of potential technologies and to retain those technologies from which a final remedy may be selected. Implementation of a preferred remedy would not restrict future management of the site or preclude future remedial alternatives.

6.1 CORRECTIVE MEASURE OBJECTIVES

Corrective action objectives are designed to protect human health and the environment, and are based upon occupational (site worker), public health, and environmental exposure criteria; information gathered during assessment and characterization; EPA guidance; and applicable state and federal regulations. To be consistent with the Order, the CMS will be completed in accordance with Appendix E of the Administrative Order and include the following objectives, which have been met under the previously mentioned interim measures:

- Be protective of human health and the environment
- Attain media cleanup goals
- Control the source(s) so as to reduce or further eliminate, to the extent practicable, further releases that may pose a threat to human health and the environment
- Comply with waste management standards

To be protective of human health and the environment, corrective action objectives must consider source areas, pathways, and receptors. Objectives must be developed to ensure that the source area, the transport pathway, or both, do not impact receptors. Therefore, the current distribution and potential migration of contaminants and the risks associated with current or past releases must be considered when developing corrective action objectives.

The objectives focus on the exposure setting for which protection will be provided. Exposure settings take into account the COPCs, media of concern, and exposure pathways. The consideration of exposure pathways is important since protection may be achieved by reducing the likelihood of exposure, as well as reducing contaminant levels.

Additionally, contaminated material and waste streams that result from the corrective measure will be treated, stored, and disposed of in accordance with all appropriate waste management

standards. The OU2 RFI details the requirements for identification of applicable standards and provides a comprehensive list of standards that may potentially apply to the corrective measure. The list of standards is presented in Appendix A.

6.2 GENERAL CORRECTIVE MEASURES

The objectives focus on the exposure setting for which protection will be provided. Exposure settings take into account the COPCs, media of concern, and exposure pathways. The consideration of exposure pathways is important since protection may be achieved by reducing the likelihood of exposure, as well as reducing contaminant levels.

Corrective measures alternatives potentially applicable to the COPCs at OU2 were identified, and at the Asbestos Area, Paint Barrel Pits, and Acetylene Sludge Pits implemented as interim measures. No action was included as a baseline for comparison. The identified alternatives were classified into the following general corrective measure categories:

- No Action
- Risk and Hazard Management
- Containment and Engineering Control (not carried forward, as alternatives within this category have already been completed as part of interim measures)
- Active Treatment/Disposal (not carried forward, as alternatives within this category have already been completed as part of interim measures)

6.3 IDENTIFICATION AND SCREENING OF PRELIMINARY CORRECTIVE MEASURE ALTERNATIVES—OVERVIEW

Preliminary corrective measures alternatives for OU2 are based upon the results of previous environmental studies, the RFI, and completed interim measures. Preliminary corrective measures alternatives rely on preferred technologies identified based on experience, a review of applicable USEPA documents, pertinent textbooks and published articles, and vendor information.

The preliminary screening process consisted of an evaluation of the potential effectiveness and implementability of the identified corrective measure alternatives. Screening was performed for each of the categories of alternatives described in Section 6.2 and for subset technologies within each category. Preferred technologies were screened using the following criteria: 1) responsiveness to corrective action objectives, 2) implementability, and 3) performance. Technologies that passed this screening are retained and carried forward to the development of corrective measure alternatives.

The preferred technologies were evaluated using the three criteria to screen out those technologies that are not technically feasible or applicable to the existing site conditions. After each preferred technology was evaluated using these three criteria, the technology was either accepted or rejected. To be accepted, a technology had to receive a "Yes" ranking for both

responsiveness to corrective action objectives and implementability, and at least a "Fair" ranking for its performance record. This evaluation process provided a selection of technologies most likely to be responsive to corrective action objectives, implementability, and performance.

6.3.1 Responsiveness to Corrective Action Objectives

For a technology to be retained, it had to address at least one of the corrective action objectives. A "Yes" ranking indicates that a technology is responsive to one or more of the corrective action objectives. A "No" ranking indicates that a technology is not responsive to any of the corrective action objectives. Both short- and long-term responsiveness was considered in the ranking. Technologies that were clearly limited in being responsive to corrective action objectives or already completed as an interim measure were rejected without further consideration.

6.3.2 Implementability

Implementability addresses both the technical and administrative feasibility of applying a technology. Under this criterion, technologies were evaluated based upon the availability of resources and equipment, and the constructability of the corrective action. The nature of the technology had to be such that it could be implemented in a safe, cost-effective, and timely manner. Waste characteristics, site accessibility, available area, and potential land use of the site that may affect the implementation of a specific technology were considered. Mobilization and permitting or approval requirements had to be practical and previously demonstrated at similar projects. Preliminary consideration was also given to regulatory constraints such as waste handling, shipment, disposal, and treatment requirements that would affect the implementation of a technology. Technologies that were not technically or administratively feasible or already completed as an interim measure were rejected.

6.3.3 Performance

The performance of a technology is ranked "Good," "Fair," or "Poor" based upon the technology's performance as demonstrated elsewhere. Ranking was predicated on the long-term performance of the technology. Technologies with a record of proven reliability were considered to have good performance records. Technologies with an acceptable record of reliability or promising field- or pilot-testing results were considered to have fair records. Technologies with a record of poor reliability or those still in the conceptual stage of development were considered to have poor performance records.

6.4 IDENTIFICATION AND SCREENING OF PRELIMINARY CORRECTIVE MEASURE ALTERNATIVES—APPLICATION

The following sections provide an evaluation of potential technologies based upon the screening criteria discussed above (Table 6-1). Technologies retained after this screening were used to develop specific corrective measures alternatives.

6.4.1 General Corrective Measure I—No Action

The no-action alternative is used to provide a baseline against which remedial action technologies can be compared. The no-action response would leave OU2 "as is," with no provisions for monitoring or control. The no-action alternative may be justified in some cases, especially where implementing a corrective measure would result in no significant reduction of risk to human health and the environment. The no-action response is readily implemented and is the least expensive corrective measure possible.

6.4.2 General Corrective Measure II—Risk and Hazard Management

The controls utilized in this corrective measure include long-term monitoring, long-term surveillance and maintenance, long-term access controls (e.g., signage, fencing, and security patrols), restrictions on future land use, and protection of construction workers during intrusive activities. The effectiveness and implementability of these controls has been demonstrated at many waste disposal sites throughout the United States.

Institutional controls are non-engineered instruments that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land or resource (e.g., groundwater) use. They include administrative or legal controls, physical barriers or markers, and methods to preserve information and data and inform current and future workers of hazards and risks. Also included are operational safety requirements implemented to ensure worker safety and the proper handling of hazardous materials during remedial activities. Institutional controls are generally used when remedies are ongoing and when residual contamination is present at a level that does not allow for unrestricted use after cleanup.

Affected portions of OU2 subject to restricted use would be regulated through a Land Use Covenant (LUC), in accordance with the Nebraska Uniform Environmental Covenants Act (Appendix B). The LUC would not be a site-wide control, but would be placed on the individual parcels that are subject to land use restrictions. Within OU2, land use restrictions would be implemented as follows:

- Development of residential facilities would be prohibited unless subsequent remedial actions or development of a mitigation and/or monitoring plan to ensure that COPC exposures contributing to risks were below levels of concern were submitted to, and approved by, the USEPA.
- Industrial or commercial land use would be permitted without restriction within OU2.

6.5 EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES AND SELECTION OF TECHNOLOGIES

Table 6-2 summarizes the technologies accepted or rejected following the identification and screening of preliminary corrective measures alternatives. This screening resulted in the selection of candidate technologies which are acceptable for use in developing the corrective measures alternatives for OU2.

TABLE 6-1

DESCRIPTION AND EVALUATION OF GENERAL CORRECTIVE MEASURES

Corrective Measure	Technology Description	Technology Evaluation		
		Responsiveness to Corrective Action Objectives	Implementability	Performance
No Action	No Action is a general corrective measure that is carried through the CMS in order to provide a baseline for comparison against remedial action technologies. No Action can be implemented with or without ICs.			
	a) No Action with no ICs	No	Yes	Poor
	b) No Action with ICs	Yes	Yes	Fair
	Comments			
No Action with no ICs is not responsive to corrective action objectives because it does not minimize exposure to site workers and the public; limit migration of contaminants to groundwater; or prevent or limit human intrusion. No Action with ICs is generally responsive to Corrective Action Objectives. ICs include long-term access controls. The No Action corrective measure is technically and administratively implementable.				

TABLE 6-1

DESCRIPTION AND EVALUATION OF GENERAL CORRECTIVE MEASURES

Corrective Measure	Technology Description	Technology Evaluation		
		Responsiveness to Corrective Action Objectives	Implementability	Performance
ICs	Access Controls: These controls would involve administrative controls to prevent or limit human exposure to contaminants. Administrative controls would include land use restrictions.	Yes	Yes	Good
Comments				
Access controls alone are not responsive to all Corrective Action Objectives. However, when used in conjunction with other technologies, these controls may increase the overall effectiveness of corrective measures. Installation of controls is technically and administratively implementable. Access controls have a long industrial record of proven performance. Administrative controls provide an extra degree of protection of human health and are simple to implement.				

TABLE 6-2

RESULTS OF TECHNOLOGY SCREENING

Technology	Screening Criteria			
	Responsiveness to Corrective Action Objectives[a] (Yes/No)	Implementability[b] (Yes/No)	Performance (Good, Fair, Poor)	Screening Evaluation (Accepted/ Rejected)
No Action with no Institutional Controls	No	Yes	Poor	Rejected
No Action with Institutional Controls	Yes	Yes	Fair	Accepted
Access Controls	Yes	Yes	Good	Accepted

a "Yes" implies that the technology is responsive to at least one of the corrective action objectives

b "Yes" implies that the technology is technically or administratively implementable.

SECTION SEVEN Development/Evaluation of Corrective Measure Alternatives

The development of corrective measures alternatives is based upon the identification and screening of applicable technologies in Chapter 6.0, which resulted in the selection of two candidate technologies as well as the no-action baseline alternative. The no-action alternative is used to provide a baseline against which remedial action technologies are compared. This chapter develops corrective measure alternatives using individual technologies or various combinations of these technologies based upon engineering practice to determine which of the candidate technologies are suitable for the site. Technologies considered suitable are carried forward to Chapter 8.0 for detailed evaluation.

7.1 ALTERNATIVE DEVELOPMENT—OVERVIEW

The accepted technologies are systematically considered in developing alternatives for OU2. The no-action alternative is retained for baseline and comparative purposes. Key concepts in the development of alternatives are discussed below.

Development of alternatives is used to reduce the large number of candidate technologies to a manageable number of alternatives for detailed evaluation. EPA guidance recommends that three general criteria be used for alternative development: 1) effectiveness, 2) implementability, and 3) cost. The next three subsections describe how these criteria are employed in this CMS.

7.1.1 Effectiveness

The effectiveness criterion is based upon the responsiveness to each corrective action objective.

7.1.2 Implementability

The implementability criterion considers: 1) constructability, 2) site worker health and safety, and 3) site maintenance requirements.

The constructability of an alternative refers to the ease of installation, degree of construction difficulty or extent of logistical problems. To be acceptable, an alternative must be considered constructible based upon judgment rendered by experienced professionals.

With respect to health and safety, each alternative was evaluated for the level of protection that must be provided during construction to minimize occupational health and safety hazards to site workers. These hazards include chemical exposure, danger from construction and process machinery, heat stress, pressure hazards, noise, and ergonomic work strain. The health and safety risk of each alternative was ranked as low, medium, or high, depending upon the associated health and safety hazards to site workers.

Site maintenance requirements consist of long-term activities required to ensure continued performance of the implemented alternative.

7.1.3 Cost

This criterion addresses the cost evaluation of an alternative based upon direct capital costs on a net present value basis. Cost estimates were developed using conceptual designs with sufficient

detail for determining material quantities, labor time, and unit prices. The estimated total cost for each alternative includes materials, equipment, and labor needed to accomplish the corrective measure. Cost was used only for comparative purposes. No alternatives were eliminated from detailed evaluation because of cost considerations exclusively.

7.2 ALTERNATIVES DEVELOPMENT—APPLICATION

Corrective measure alternatives for OU2 are developed by making selections from the various candidate technologies. Table 7-1 summarizes the development of alternatives. The alternatives depicted in Table 7-1 are evaluated sequentially in the following subsections based upon the three general criteria outlined in Sections 7.1.1 (Effectiveness), 7.1.2 (Implementability), and 7.1.3 (Cost).

Alternative I.b—No Action with Institutional Controls

Under this alternative, no actions would be undertaken at OU2 except for filing a restrictive covenant Institutional Control with the Douglas County Register of Deeds (Appendix B). This baseline alternative is directly responsive to the corrective action objectives as long as the Institutional Control is maintained and enforced. The effectiveness, implementability, and cost of this alternative are discussed below.

Effectiveness

Minimize Exposure to Site Workers and the Public. This alternative poses little exposure risk to site workers and the public.

Limit Migration of Contaminants to Groundwater. This alternative would not provide further protection against water infiltration and the release of contaminants to groundwater.

Prevent or Limit Human Intrusion. ICs will provide adequate protection against human intrusion as long as ICs are maintained and enforced.

Implementability

Constructability. Construction and logistical problems associated with No Action and Institutional Controls are insignificant as no additional activities would be undertaken.

Health and Safety. Health and safety concerns for site workers are minimal. There would be no intrusive activities at the site. No potential for exposure to waste exists. Health and safety risk for site workers is ranked low.

Maintenance. Maintenance and logistical problems associated with No Action and Institutional Controls are insignificant as no additional activities would be undertaken.

Cost

Direct capital costs for the No Action with Institutional Controls alternative are $14,310. Estimated costs for all alternatives are provided in Table 7-2.

7.3 ALTERNATIVE DEVELOPMENT—SUMMARY

Development of corrective measure alternatives based on previous interim measures, existing human health risk assessment, and individual technologies or various combinations of technologies resulted in the selection of one candidate corrective measures that is suitable for OU2. Remedies that prevent or limit future migration of contaminants from soils can be implemented quickly and easily with less difficulty, and cost less without sacrificing protection of human health and the environment are preferred. The alternative development evaluation criteria summary is presented in Table 7-2. Based upon the evaluation criteria, the corrective measure alternative listed below was determined to be suitable for OU2:

- Alternative I.b—No Action with Institutional Controls

7.4 ALTERNATIVE EVALUATION—OVERVIEW

The alternatives considered suitable for OU2 in Table 7-2 is systematically considered in this final, detailed evaluation of corrective measures alternatives. Five evaluation criteria are considered appropriate by the USEPA in selecting an alternative that represents a technology or combination of technologies that address the environmental issues at the site. The five evaluation criteria are as follows:

1. Long-term reliability and effectiveness
2. Reduction of toxicity, mobility, or volume of wastes
3. Short-term effectiveness
4. Implementability
5. Cost

The following sections describe how these evaluation criteria are employed in this CMS.

7.5 DESCRIPTION OF EVALUATION CRITERIA FOR DETAILED ANALYSIS

The order of the evaluation criteria listed above is not intended to establish an implicit ranking, nor does it suggest the relative importance each criterion might have at OU2. There are circumstances in which any given criteria might receive particular weight (e.g., long-term effectiveness may rule out alternatives that might achieve remedial goals in the short term, but at the expense of creating new or greater future risks that may necessitate a future corrective action). Conversely, alternatives that significantly reduce potential or actual human exposure in the short term may be preferred over alternatives that eliminate long-term risks, but at the cost of

lengthening the period during which potential exposure exists. A general description of the five criteria and how they will be used in alternative selection is provided in the following sections.

7.5.1 Long-Term Reliability and Effectiveness

Each candidate alternative was evaluated for long-term reliability and effectiveness. This factor includes consideration of the level of risk that will remain after implementation of the alternative, the extent of long-term monitoring and other management controls that will be required after implementation of the alternative, the uncertainties associated with leaving contaminants in place, and the potential for failure of the alternative. An alternative that reduces risk with little long-term management and that has proven effective under similar conditions is preferred by the USEPA.

7.5.2 Reduction of Toxicity, Mobility, or Volume of Wastes

Each candidate alternative was evaluated for its reduction in toxicity, mobility, and volume of contaminants. An alternative that incorporates treatment to more completely and permanently reduce the toxicity, mobility, and volume of contaminants is preferred by the USEPA.

7.5.3 Short-Term Effectiveness

Each candidate alternative was evaluated for its short-term effectiveness. This factor includes consideration of the short-term reduction in existing risk that the alternative would achieve; the time needed to achieve that reduction; and the potential short-term risks to the community, site workers, and the environment during implementation of the alternative. An alternative that quickly reduces short-term risk without creating significant additional risk is preferred by the USEPA.

7.5.4 Implementability

Each candidate alternative was evaluated for its implementability, or the difficulty of implementing the alternative. This factor includes consideration of installation and construction difficulties; operation and maintenance difficulties; difficulties with cleanup technologies; permitting and approvals; and the availability of necessary equipment, services, expertise, and storage and disposal capacity. An alternative that can be implemented quickly and easily while posing lesser difficulty is preferred by the USEPA.

7.5.5 Cost

Each candidate alternative was evaluated for cost, which included capital costs and operation and maintenance costs. Capital costs consisted of construction and installation costs; equipment costs; and indirect costs including engineering costs, legal fees, permitting fees, start-up and shakedown costs; and contingency allowances. Operation and maintenance costs were estimated for 30 years and include operating labor and material costs, maintenance labor and material costs, replacement costs, utilities, monitoring and reporting costs, administrative costs, indirect costs, and contingency allowances. All costs were calculated on their net present value. An

alternative that is less costly but does not sacrifice protection of human health and the environment is preferred by the USEPA.

7.6 ALTERNATIVE EVALUATION—APPLICATION

Candidate alternatives for OU2 were evaluated using the criteria listed in Section 7.5. Alternative evaluation is depicted in Table 7-3. The alternative depicted in Table 7-3 is evaluated sequentially in the following sections based upon the five evaluation criteria outlined in Section 7.5. The No Action with No Institutional Controls alternative is not included in this chapter for detailed evaluation.

Alternative I.b—No Action with Institutional Controls

Under this candidate alternative, no additional actions would be undertaken at OU2 except for filing a restrictive covenant Institutional Control with the Douglas County Register of Deeds. There would be no additional intrusive activities at the site.

Long-Term Reliability and Effectiveness

The magnitude of risk remaining after implementation of this alternative in terms of potential exposure to COPCs to a human receptor is quantified as a hazard index (HI) of 0.20 (0.60 using revised toxicity factors) and an excess cancer risk using the RME concentrations of 7×10^{-6} (7×10^{-6} using revised toxicity factors) for a construction worker in a commercial/industrial land use scenario. The HI is below the USEPA target value of 1 and the cancer risk is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. Detailed risk assessment and summary tables can be found in the OU2 RFI (URS 2001) and Section 5.3.

There is low uncertainty in the land use scenario and the potentially affected populations. The parameter values used in the calculations are conservative and the calculated intakes are likely to be overestimated. Toxicological parameter values were taken from EPA national and regional databases. The overall uncertainty in all of the steps in the risk assessment process is considered insignificant with respect to the conclusion reached.

Institutional Controls, such as deed restrictions, would be used to prevent or limit exposure to the remaining soil and to ensure the effectiveness of this alternative.

Reduction of Toxicity, Mobility, or Volume

This candidate alternative does not include any additional waste treatment options. As such, this alternative does not further reduce waste toxicity or volume from what has been completed through the interim measures. The mobility of the remaining soil will be minimized by limiting human access and inadvertent human intrusion.

Short-Term Effectiveness

The time required to implement this alternative is one month. Short-term risks for implementing this alternative are minimal.

Implementability

This candidate alternative poses no administrative or technical implementation challenges. Construction and logistical problems associated with No Action with Institutional Controls are insignificant. The integrity and performance of the alternative can be easily monitored and preparation and filing of the Institutional Control is readily available.

Cost

Capital and operation and maintenance costs for the No Action with Institutional Controls alternative are $54,596. Estimated capital and operation and maintenance costs for all alternatives are provided in Table 7-3.

7.7 ALTERNATIVES EVALUATION—SUMMARY

Detailed evaluation of candidate alternatives resulted in Alternative I.b (No Action with Institutional Controls) presenting the lowest overall risk of all the alternatives considered. As with the other alternatives that require some type of construction activities, transportation and remediation injuries and fatalities drive the risk.

For Alternative I.b (No Action with Institutional Controls), the HI, a measure of potential noncarcinogenic adverse effects from exposure to COPCs, is 0.20 (0.60 using revised toxicity factors), which is below the USEPA target value of 1 for construction workers. The predicted number of human health cancers from COPCs is 7×10^{-6} (7×10^{-6} using revised toxicity factors) for a construction worker, which is within the USEPA target risk range of 1×10^{-6} to 1×10^{-4}. The overall risk for No Action with Institutional Controls is very low.

Alternative I.b (No Action with Institutional Controls) presents a lower overall cost than other construction activity alternatives and the completed interim measures. The USEPA considers cost an important consideration in selecting corrective measures. Cost can and should be considered when choosing among candidate alternatives that meet the evaluation criteria. USEPA believes that several alternatives will meet all the evaluation criteria and in that situation, cost becomes an important consideration in choosing the alternative that most appropriately addresses the circumstances at the site and provides the most efficient use of agency and owner resources.

TABLE 7-1

DEVELOPMENT OF CORRECTIVE MEASURES ALTERNATIVES

Alternative	Description	Technology	
		No Action	Access Controls
I.a	No Action	X	
I.b	No Action with Institutional Controls	X	X

Institutional Controls include restrictive covenants

TABLE 7-2

SUMMARY OF DEVELOPMENT OF CORRECTIVE MEASURES ALTERNATIVES

Alternative	Description	Effectiveness			Implementability			Relative Costs	Evaluation Summary
		Minimize Exposure to Workers and the Public	Limit Migration of Contaminants to Groundwater	Prevent or Limit Human Intrusion	Constructability Concerns	Worker Health and Safety Risk	Maintenance Requirements		
I.a	No Action	Yes	Yes	Yes	Insignificant	Low	Minimal	No Capital No O&M	Unsuitable
I.b	No Action with Institutional Controls	Yes	Yes	Yes	Insignificant	Low	Minimal	Low Capital Low O&M	Suitable

Institutional Controls include restrictive covenants

TABLE 7-3

DETAILED SUMMARY OF CORRECTIVE MEASURES ALTERNATIVES

Evaluation Criteria	I.b No Action with Institutional Controls
Long-Term Reliability and Effectiveness	
Magnitude of Remaining Risk after Implementation of the Alternative	No reduction in risk, however, existing risk under the commercial/industrial exposure are within or below current USEPA target values.
Adequacy and reliability of controls	Good. ICs include site surveillance and maintenance.
Uncertainties Associated with Leaving Soil in Place	Low
Potential for Failure of Alternative	Very Low
Reduction in Toxicity, Mobility, and Volume	
Reduction in Toxicity	No reduction
Reduction in Mobility	Minimal human access and inadvertent human intrusion protection
Reduction in Volume	None
Short-Term Effectiveness	
Short-Term Reduction in Existing Risk	None. However, existing risk under the commercial/industrial exposure are within or below current USEPA target values.
Time Needed to Achieve Objectives	1 month
Short-Term Risk Posed to Site Workers, the Community, and the Environment During Implementation of the Alternative	Low

TABLE 7-3

DETAILED SUMMARY OF CORRECTIVE MEASURES ALTERNATIVES

Evaluation Criteria	I.b No Action with Institutional Controls
Implementability	
Availability of Materials, Equipment, and Contractors	Readily available
Technical and Administrative Difficulties	None
Permits and Approvals	Easily obtained
Cost	
Capital Operation and Maintenance Net Present Value	$ 14,310 $ 3,881 $ 54,596

Institutional Controls include restrictive covenants

The purpose of this CMS is to identify, develop, and evaluate corrective measure alternatives and recommend the corrective measure to be taken at OU2. As part of this CMS process, 3 technologies in 2 general corrective measures families were screened against CMS corrective action objectives and criteria specified by the USEPA (Table 6-1). Screening of these technologies resulted in the selection of two candidate technologies for development of corrective measures alternatives.

Based upon detailed evaluation using guidance provided by the USEPA, one candidate corrective measures alternative clearly presents the lowest overall risk to human health and the environment, while minimizing cost and meeting CMS corrective action objectives. This alternative is Alternative I.b—No Action with Institutional Controls. This alternative is proposed for OU2 as the preferred corrective measure.

In selecting Alternative I.b (No Action with Institutional Controls) as the preferred corrective measure for OU2, UPRR is demonstrating their commitment to protect the environment, to preserve the health and safety of the public and their employees, and to serve as responsible corporate citizens in meeting the community's environmental goals.

HDR Engineering, Inc. 1990. Site Investigation Report. Omaha Shops and Maintenance Facility Environmental Assessment. Prepared for Union Pacific Railroad Company. Omaha, Nebraska.

Koener, R.M. and D.E. Daniel. 1997. Final Covers for Solid Waste Landfills and Abandoned Dumps. ASCE Press.

Soil Conservation Service. 1975. Soil Survey of Douglas and Sarpy Counties, Nebraska. U.S. Department of Agriculture.

SOS International. 1988. Omaha Shops – Building Survey (Asbestos). Prepared for Union Pacific Railroad Company. Omaha, Nebraska.

Terracon. 1988. Diesel Recovery Design (Phase I). Union Pacific Rail Yard. Omaha, Nebraska. Prepared for Union Pacific Railroad Company. Omaha, Nebraska.

Tetra Tech EM Inc. (Tetra Tech). 1998. RCRA Facility Assessment. Union Pacific Railroad. Omaha, Nebraska. June.

Union Pacific System (UPRR). 1984. Geologic and Hydrologic Investigation of Union Pacific's Omaha Yard and Vicinity. Prepared for the Nebraska Department of Environmental Control. Union Pacific System Planning and Analysis Department. January.

United States Environmental Protection Agency (USEPA). 1991. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual; Part B, Development of Risk-Based Preliminary Remediation Goals. Interim. Publication 9285.7-01B. December.

United States Environmental Protection Agency (USEPA). 1993. Memorandum: Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis. OSWER Directive No. 9355.3-20. June 25.

United States Environmental Protection Agency (USEPA). 1999. Administrative Order on Consent. Union Pacific Railroad Omaha Shops. April.

United States Pollution Control Inc. (USPCI). 1988a. PCB Transformer Survey. Omaha Shops. Prepared for Union Pacific Railroad Company. Omaha, Nebraska.

United States Pollution Control Inc. (USPCI). 1988b. Preliminary Site Assessment. Omaha Shops. Prepared for Union Pacific Railroad Company. Omaha, Nebraska.

URS Corporation (URS). 2001a. Draft Asbestos Interim Measures Completion Report, Omaha Shops. Omaha, Nebraska. August.

URS Corporation (URS). 2001b. Draft Paint Barrel Pits Interim Measures Completion Report, Omaha Shops. Omaha, Nebraska. August.

URS Corporation (URS). 2001c. Draft RCRA Facilities Investigation Operable Unit No. 2 (OU2), Omaha Shops, Omaha, Nebraska. November.

URS Corporation (URS). 2002. Draft Acetylene Sludge Pits Interim Measures Completion Report, Omaha Shops. Omaha, Nebraska. August.

Woodward-Clyde (W-C). 1995. Phase II Site Assessment, Construction Area, Omaha Shops. Omaha, Nebraska. December.

Woodward-Clyde (W-C). 1996. Remedial Action Plan, UPRR Omaha Shops, Omaha, Nebraska. August.

Construction Worker

TABLE A-1

INCIDENTAL INGESTION OF CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
CONSTRUCTION WORKER SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CS x SI x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SI = Soil Ingestion Rate (mg/day soil)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor (mg/kg-day)-1
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	RME CS (mg/kg)	SI (mg/dy)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	Subchronic RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs														
Tetrachloroethene	6.68E+02	100	120	1	1.00E-06	70	120	25550	9.54E-04	1.00E-01	1.00E-02	4.48E-06	5.40E-01	2.42E-06
Trichloroethene	2.90E+01	100	120	1	1.00E-06	70	120	25550	4.14E-05	3.00E-04	1.38E-01	1.95E-07	4.00E-01	7.78E-08

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 1.48E-01

TOTAL CANCER RISK = 2.50E-06

TABLE A-2

DERMAL EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
CONSTRUCTION WORKER SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CS x SA x AD x AB x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where: CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SA = Exposed Body Surface Area (cm^2)
AD = Soil Adherence to Skin (mg/cm^2)
AB = Percent Chemical Absorption Across Skin (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	RME CS (mg/kg)	SA (cm^2)	AD (mg/cm^2)	AB (unitless)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs																
Tetrachloroethene	6.68E+02	5230	0.04	0.010	120	1	1.00E-06	70	120	25550	2.00E-05	1.00E-01	2.00E-04	9.38E-08	5.40E-01	5.06E-08
Trichloroethene	2.90E+01	5230	0.04	0.010	120	1	1.00E-06	70	120	25550	8.67E-07	3.00E-04	2.89E-03	4.07E-09	4.00E-01	1.63E-09

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 3.09E-03

TOTAL CANCER RISK = 5.23E-08

TABLE A-3

INHALATION EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
CONSTRUCTION WORKER SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CX x IH x ET x EF x ED)/(BW x AT1 or AT2)**

Hazard Quotient = CDI / RfD

Cancer Risk = SF x CDI

Where:

CDI = Chronic Daily Intake (mg/kg-day)
CX = Chemical Concentration in Air (mg/m^3)
IH = Inhalation Rate (m^3/h)
ET = Exposure Time (h/d)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)

BW = Body Weight (kg)
AT1 = Averaging Time for Non-carcinogenic Effects (days)
AT2 = Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	CX (mg/m^3)	IH (m^3/h)	ET (h/d)	EF (d/y)	ED (yr)	BW (kg)	AT1 non-cancer	AT2 cancer	CDI non-cancer	RfD	Hazard Quotient	CDI cancer	Slope Factor	Cancer Risk
VOCs														
Tetrachloroethene	6.58E-02	2.5	12	120	1	70	120	25550	2.82E-02	8.00E-02	3.53E-01	1.33E-04	2.00E-02	2.65E-06
Trichloroethene	2.71E-03	2.5	12	120	1	70	120	25550	1.16E-03	1.00E-02	1.16E-01	5.46E-06	4.00E-01	2.18E-06
									Total Hazard Index=		4.69E-01	Total Cancer Risk=		4.83E-06

TABLE A-4

INCIDENTAL INGESTION OF CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
CONSTRUCTION WORKER SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CS x SI x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SI = Soil Ingestion Rate (mg/day soil)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor (mg/kg-day)-1
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	AVG CS (mg/kg)	SI (mg/dy)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	Subchronic RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF (mg/kg-day)$^{-1}$	CANCER RISK (unitless)
VOCs														
Tetrachloroethene	3.88E+01	50	90	1	1.00E-06	70	90	25550	2.77E-05	1.00E-01	2.77E-04	9.76E-08	5.40E-01	5.27E-08
Trichloroethene	1.36E+00	50	90	1	1.00E-06	70	90	25550	9.71E-07	3.00E-04	3.24E-03	3.42E-09	4.00E-01	1.37E-09
NTF = No Toxicity Factor										TOTAL HAZARD INDEX =	3.52E-03		TOTAL CANCER RISK =	5.41E-08

TABLE A-5

DERMAL EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
CONSTRUCTION WORKER SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CS x SA x AD x AB x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where: CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SA = Exposed Body Surface Area (cm^2)
AD = Soil Adherence to Skin (mg/cm^2)
AB = Percent Chemical Absorption Across Skin (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	Average CS (mg/kg)	SA (cm^2)	AD (mg/cm^2)	AB (unitless)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs																
Tetrachloroethene	3.88E+01	3160	0.06	0.010	90	1	1.00E-06	70	90	25550	1.05E-06	1.00E-01	1.05E-05	3.70E-09	5.20E-02	1.92E-10
Trichloroethene	1.36E+00	3160	0.06	0.010	90	1	1.00E-06	70	90	25550	3.68E-08	3.00E-04	1.23E-04	1.30E-10	1.10E-02	1.43E-12

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 1.33E-04

TOTAL CANCER RISK = 1.94E-10

TABLE A-6

INHALATION EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
CONSTRUCTION WORKER SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CX x IH x ET x EF x ED)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CX = Chemical Concentration in Air (mg/m^3)
IH = Inhalation Rate (m^3/h)
ET = Exposure Time (h/d)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT1 = Averaging Time for Non-carcinogenic Effects (days)
AT2 = Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	CX (mg/m^3)	IH (m^3/h)	ET (h/d)	EF (d/y)	ED (yr)	BW (kg)	AT1 non-cancer	AT2 cancer	CDI non-cancer	RfD	Hazard Quotient	CDI cancer	Slope Factor	Cancer Risk
VOCs														
Tetrachloroethene	6.58E-02	1.3	10	90	1	70	90	25550	1.22E-02	8.00E-02	1.53E-01	4.31E-05	2.00E-02	8.61E-07
Trichloroethene	2.71E-03	1.3	10	90	1	70	90	25550	5.04E-04	1.00E-02	5.04E-02	1.77E-06	4.00E-01	7.10E-07
									Total Hazard Index=		2.03E-01	Total Cancer Risk=		1.57E-06

Occupational

TABLE A-7

INCIDENTAL INGESTION OF CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
OCCUPATIONAL SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CS x SI x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SI = Soil Ingestion Rate (mg/day soil)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor (mg/kg-day)-1
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	RME CS (mg/kg)	SI (mg/dy)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs														
Tetrachloroethene	6.68E+02	50	250	25	1.00E-06	70	9125	25550	3.27E-04	1.00E-02	3.27E-02	1.17E-04	5.40E-01	6.30E-05
Trichloroethene	2.90E+01	50	250	25	1.00E-06	70	9125	25550	1.42E-05	3.00E-04	4.73E-02	5.07E-06	4.00E-01	2.03E-06
										TOTAL HAZARD INDEX =	8.00E-02		TOTAL CANCER RISK =	6.51E-05

TABLE A-8

DERMAL EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
OCCUPATIONAL SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CS x SA x AD x AB x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where: CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SA = Exposed Body Surface Area (cm^2)
AD = Soil Adherence to Skin (mg/cm^2)
AB = Percent Chemical Absorption Across Skin (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	RME CS (mg/kg)	SA (cm^2)	AD (mg/cm^2)	AB (unitless)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs																
Tetrachloroethene	6.68E+02	3160	0.02	0.01	250	25	1.00E-06	70	9125	25550	4.13E-06	1.00E-02	4.13E-04	1.48E-06	5.40E-01	7.97E-07
Trichloroethene	2.90E+01	3160	0.02	0.01	250	25	1.00E-06	70	9125	25550	1.79E-07	3.00E-04	5.98E-04	6.40E-08	4.00E-01	2.56E-08

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 1.01E-03 TOTAL CANCER RISK = 8.22E-07

TABLE A-9

INHALATION EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
OCCUPATIONAL SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CX x IH x ET x EF x ED)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CX = Chemical Concentration in Air (mg/m^3)
IH = Inhalation Rate (m^3/h)
ET = Exposure Time (h/d)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	CX (mg/m^3)	IH (m^3/h)	ET (h/d)	EF (d/y)	ED (yr)	BW (kg)	AT1 non-cancer	AT2 cancer	CDI non-cancer	RfD	Hazard Quotient	CDI cancer	Slope Factor	Cancer Risk
VOCs														
Tetrachloroethene	6.58E-02	2.5	8	250	25	70	9125	25550	1.29E-02	8.00E-02	1.61E-01	4.60E-03	2.00E-02	9.20E-05
Trichloroethene	2.71E-03	2.5	8	250	25	70	9125	25550	5.31E-04	1.00E-02	5.31E-02	1.90E-04	4.00E-01	7.58E-05
									Total Hazard Index=		2.14E-01	Total Cancer Risk=		1.68E-04

TABLE A-10

INCIDENTAL INGESTION OF CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
OCCUPATIONAL SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CS x SI x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SI = Soil Ingestion Rate (mg/day soil)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)

BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor (mg/kg-day)-1
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	AVG CS (mg/kg)	SI (mg/dy)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Non-Carcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs														
Tetrachloroethene	3.88E+01	10	120	6.6	1.00E-06	70	2409	25550	1.82E-06	1.00E-02	1.82E-04	1.72E-07		
Trichloroethene	1.36E+00	10	120	6.6	1.00E-06	70	2409	25550	6.39E-08	3.00E-04	2.13E-04	6.02E-09		

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 3.95E-04 TOTAL CANCER RISK = 0.00E+00

TABLE A-11

DERMAL EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION)
OCCUPATIONAL SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CS x SA x AD x AB x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where: CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SA = Exposed Body Surface Area (cm^2)
AD = Soil Adherence to Skin (mg/cm^2)
AB = Percent Chemical Absorption Across Skin (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	Average CS (mg/kg)	SA (cm^2)	AD (mg/cm^2)	AB (unitless)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs																
Tetrachloroethene	3.88E+01	1980	0.03	0.01	120	6.6	1.00E-06	70	2409	25550	1.08E-07	1.00E-02	1.08E-05	1.02E-08		
Trichloroethene	1.36E+00	1980	0.03	0.01	120	6.6	1.00E-06	70	2409	25550	3.79E-09	3.00E-04	1.26E-05	3.58E-10		

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 2.35E-05 TOTAL CANCER RISK = 0.00E+00

TABLE A-12

INHALATION EXPOSURE TO CHEMICALS IN ACETYLENE SLUDGE PITS SOIL (POST-EXCAVATION) OCCUPATIONAL SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CX x IH x ET x EF x ED)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CX = Chemical Concentration in Air (mg/m^3)
IH = Inhalation Rate (m^3/h)
ET = Exposure Time (h/d)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	CX (mg/m^3)	IH (m^3/h)	ET (h/d)	EF (d/y)	ED (yr)	BW (kg)	AT1 non-cancer	AT2 cancer	CDI non-cancer	RfD	Hazard Quotient	CDI cancer	Slope Factor	Cancer Risk
VOCs														
Tetrachloroethene	6.58E-02	0.55	4	120	6.6	70	2409	25550	6.80E-04	8.00E-02	8.50E-03	6.41E-05	2.00E-02	1.28E-06
Trichloroethene	2.71E-03	0.55	4	120	6.6	70	2409	25550	2.80E-05	1.00E-02	2.80E-03	2.64E-06	4.00E-01	1.06E-06
									Total Hazard Index=		1.13E-02	Total Cancer Risk=		2.34E-06

Trespasser

TABLE A-13

INCIDENTAL INGESTION OF CHEMICALS IN ACETYLENE SLUDGE PIT SOIL (POST-EXCAVATION)
TRESPASSER SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CS x SI x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SI = Soil Ingestion Rate (mg/day soil)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor (mg/kg-day)-1
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	RME CS (mg/kg)	SI (mg/dy)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs														
Tetrachloroethene	6.68E+02	100	32	8	1.00E-06	56	2920	25550	1.05E-04	1.00E-02	1.05E-02	1.20E-05	5.40E-01	6.45E-06
Trichloroethene	2.90E+01	100	32	8	1.00E-06	56	2920	25550	4.54E-06	3.00E-04	1.51E-02	5.19E-07	4.00E-01	2.08E-07
NTF = No Toxicity Factor										TOTAL HAZARD INDEX =	2.56E-02		TOTAL CANCER RISK =	6.66E-06

TABLE A-14

DERMAL EXPOSURE TO CHEMICALS IN OU2 SURFACE SOIL
TRESPASSER SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CS x SA x AD x AB x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where: CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SA = Exposed Body Surface Area (cm^2)
AD = Soil Adherence to Skin (mg/cm^2)
AB = Percent Chemical Absorption Across Skin (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	RME CS (mg/kg)	SA (cm^2)	AD (mg/cm^2)	AB (unitless)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs																
Tetrachloroethene	6.68E+02	9494	0.15	0.01	32	8	1.00E-06	56	2920	25550	1.49E-05	1.00E-02	1.49E-03	1.70E-06	5.40E-01	9.19E-07
Trichloroethene	2.90E+01	9494	0.15	0.01	32	8	1.00E-06	56	2920	25550	6.47E-07	3.00E-04	2.16E-03	7.39E-08	4.00E-01	2.96E-08

NTF = No Toxicity Factor

TOTAL HAZARD INDEX = 3.64E-03 TOTAL CANCER RISK = 9.49E-07

TABLE A-15

INHALATION EXPOSURE TO CHEMICALS IN OU2 SURFACE SOIL
TRESPASSER SCENARIO - REASONABLE MAXIMUM EXPOSURE

Equation: **CDI = (CX x IH x ET x EF x ED)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CX = Chemical Concentration in Air (mg/m^3)
IH = Inhalation Rate (m^3/h)
ET = Exposure Time (h/d)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	CX (mg/m^3)	IH (m^3/h)	ET (h/d)	EF (d/y)	ED (yr)	BW (kg)	AT1 non-cancer	AT2 cancer	CDI non-cancer	RfD	Hazard Quotient	CDI cancer	Slope Factor	Cancer Risk
VOCs														
Tetrachloroethene	6.58E-02	1	4	32	8	56	2920	25550	4.12E-04	8.00E-02	5.15E-03	4.71E-05	2.00E-02	9.42E-07
Trichloroethene	2.71E-03	1	4	32	8	56	2920	25550	1.70E-05	1.00E-02	1.70E-03	1.94E-06	4.00E-01	7.76E-07
									Total Hazard Index=		6.85E-03	Total Cancer Risk=		1.72E-06

TABLE A-16

INCIDENTAL INGESTION OF CHEMICALS IN OU2 SURFACE SOIL
TRESPASSER SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CS x SI x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SI = Soil Ingestion Rate (mg/day soil)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor (mg/kg-day)-1
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	AVG CS (mg/kg)	SI (mg/dy)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs														
Tetrachloroethene	3.88E+01	50	24	8	1.00E-06	56	2920	25550	2.28E-06	1.00E-02	2.28E-04	2.60E-07	5.40E-01	1.41E-07
Trichloroethene	1.36E+00	50	24	8	1.00E-06	56	2920	25550	7.98E-08	3.00E-04	2.66E-04	9.12E-09	4.00E-01	3.65E-09
NTF = No Toxicity Factor										TOTAL HAZARD INDEX =	4.94E-04		TOTAL CANCER RISK =	1.44E-07

TABLE A-17

DERMAL EXPOSURE TO CHEMICALS IN OU2 SURFACE SOIL
TRESPASSER SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CS x SA x AD x AB x EF x ED x CF)/(BW x AT1 or AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = SF x CDI

Where: CDI = Chronic Daily Intake (mg/kg-day)
CS = Chemical Concentration in Soil (mg/kg soil)
SA = Exposed Body Surface Area (cm^2)
AD = Soil Adherence to Skin (mg/cm^2)
AB = Percent Chemical Absorption Across Skin (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor (kg/mg)
BW = Body Weight (kg)
AT1 =Averaging Time for Non-carcinogenic Effects (days)
AT2 =Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	Average CS (mg/kg)	SA (cm^2)	AD (mg/cm^2)	AB (unitless)	EF (dy/yr)	ED (yr)	CF (kg/mg)	BW (kg)	AT1 (dy)	AT2 (dy)	Noncarcinogenic CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	Carcinogenic CDI (mg/kg-dy)	SF $(mg/kg\text{-}day)^{-1}$	CANCER RISK (unitless)
VOCs																
Tetrachloroethene	3.88E+01	4342	0.14	0.01	24	8	1.00E-06	56	2920	25550	2.77E-07	1.00E-02	2.77E-05	3.16E-08	5.40E-01	1.71E-08
Trichloroethene	1.36E+00	4342	0.14	0.01	24	8	1.00E-06	56	2920	25550	9.71E-09	3.00E-04	3.24E-05	1.11E-09	4.00E-01	4.44E-10
												TOTAL HAZARD INDEX =	6.01E-05		TOTAL CANCER RISK =	1.75E-08

NTF = No Toxicity Factor

TABLE A-18

INHALATION EXPOSURE TO CHEMICALS IN OU2 SURFACE SOIL
TRESPASSER SCENARIO - AVERAGE EXPOSURE

Equation: **CDI = (CX x IH x ET x EF x ED)/(BW x AT1 or AT2)**

Hazard Quotient = CDI / RfD

Cancer Risk = SF x CDI

Where:
CDI = Chronic Daily Intake (mg/kg-day)
CX = Chemical Concentration in Air (mg/m^3)
IH = Inhalation Rate (m^3/h)
ET = Exposure Time (h/d)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT1 = Averaging Time for Non-carcinogenic Effects (days)
AT2 = Averaging Time for Carcinogenic Effects, Based on Lifetime (days)
SF = Slope Factor $(mg/kg\text{-}day)^{-1}$
RfD = reference Dose (mg/kg-day)

Potential Chemicals of Concern	CX (mg/m^3)	IH (m^3/h)	ET (h/d)	EF (d/y)	ED (yr)	BW (kg)	AT1 non-cancer	AT2 cancer	CDI non-cancer	RfD	Hazard Quotient	CDI cancer	Slope Factor	Cancer Risk
VOCs														
Tetrachloroethene	6.58E-02	0.4	2	24	8	56	2920	25550	6.19E-05	8.00E-02	7.73E-04	7.07E-06	2.00E-02	1.41E-07
Trichloroethene	2.71E-03	0.4	2	24	8	56	2920	25550	2.55E-06	1.00E-02	2.55E-04	2.91E-07	4.00E-01	1.16E-07
									Total Hazard Index=		1.03E-03	Total Cancer Risk=		2.58E-07

REQUIREMENTS FOR IDENTIFICATION OF PROTECTION STANDARDS

The Order requires identification of protection standards in the RFI report, and they have been restated for the CMS report. This includes identification of "all relevant and applicable standards for the protection of human health and the environment (e.g., national Ambient Air Quality Standards, Federally approved state water quality standards, etc.)." While USEPA's RFI guidance requires consideration of other laws, regulations, and standards, no RCRA guidance for identification of relevant and applicable protection standards is available; therefore, guidance developed under CERCLA for identification of applicable or relevant and appropriate requirements (ARARs) was followed.

Identification of, and compliance with, ARARs is mandated by CERCLA (as amended by the Superfund Amendments and Reauthorization Act [SARA]) and by its implementing regulations, contained in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP 40 CFR Part 300). As part of the NCP's remedial investigation/feasibility study (RI/FS) process (which is somewhat analogous to the RCRA RFI/CMS process), remedial alternatives, including the no-action alternative, are evaluated to assess the degree to which they attain or exceed ARARs. This process is intended to provide a measure of the effectiveness of remedial alternatives in relation to protection of human health and the environment. A preliminary identification of potential ARARs during project scoping assists in initially identifying remedial action objectives and is useful for initiating communications and consultations with responsible agencies. ARAR identification continues throughout the RFI/CMS as a better understanding is gained of site conditions, site contaminants, exposure pathways, and remedial action alternatives.

ARARs include standards, requirements, criteria, or limitations established under Federal environmental law, or more stringent standards, requirements, criteria, or limitations promulgated (i.e., of general applicability and legally enforceable) in accordance with a State environmental statute.

"Applicable" standards are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State laws that specifically address a hazardous substance, contaminant, remedial action, or locational circumstance.

"Relevant and appropriate" standards are those that apply to circumstances sufficiently similar to those encountered at a CERCLA site that, although otherwise not legally required, their application would be appropriate at that specific site. If a requirement is found to be relevant and appropriate under the NCP, it will be treated in the same way as an applicable requirement.

"To be considered" standards (TBCs) are nonpromulgated advisories, proposed rules, criteria, or guidance documents issued by Federal or State governments that do not have the status of potential ARARs. These advisories and guidance are to be considered when determining protective cleanup levels where no ARAR exists, or where ARARs are not sufficiently protective of human health and the environment.

Based on EPA guidance (EPA 1988), ARARs are categorized as chemical-specific, action-specific, or location-specific:

Chemical-Specific ARARs. Chemical-specific ARARs include laws and requirements that establish levels that are considered protective of human health and the environment for specific chemicals in designated media. Chemical-specific ARARs regulate the discharge of residues if they are part of the remedial action. They are used to help determine the level of remediation and the allowable levels of residues following treatment. Maximum contaminant levels in the Safe Drinking Water Act are examples of chemical-specific ARAR.

Action-Specific ARARs. Action-specific ARARs are not established for a specific contaminant; rather, they define treatment and disposal activities for hazardous substances and control remedial actions to limit the release of hazardous substances to the environment during the action. Performance levels, actions, or remedial technologies may be established, as well as specific contaminant levels, for discharge of residues. Each action-specific requirement will differ depending on the remedial action objectives. Closure requirements under RCRA Subtitles C and D are examples of action-specific ARARs.

Location-Specific ARARs. Location-specific ARARs establish restrictions that are related to the geographic location of the site and surrounding areas, such as wetlands, sensitive habitats, floodplains, and historical places. The 100-year floodplain requirements of 40 CFR 264.18(b) is an example of a location-specific ARAR.

As a general rule, response actions that meet ARARs are effective in preventing or minimizing the release of contaminants, and thereby reduce present and future risk to public health and the environment.

PROTECTION STANDARDS

The analysis of protection standards/ARARs for the RFI and this CMS was completed in accordance with the following USEPA guidance documents:

- EPA/530/SW-89-031, Interim Final RCRA Facility Investigation (RFI) Guidance (OSWER Directive 9502.00-6D)
- EPA/540/G-89/004, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA
- EPA/540/G-89/006, CERCLA Compliance with Other Laws Manual
- EPA/540/G-89/009, CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes and State Requirements

Comprehensive lists of chemical-specific, action-specific, and location-specific ARARs and TBCs are included in Tables A-1 through A-3 (the CERCLA terminology is used in the tables). The tables include comments regarding the applicability or relevance and appropriateness of a potential ARAR. Only those requirements that are judged to be applicable or relevant and appropriate will be carried forward for consideration at OU2 during future evaluation; however, this will require concurrence from the appropriate regulatory agency.

TABLE B-1

POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Federal			
Solid Waste Disposal Act (SWDA), as amended	42 USCA Sect. 6901-6992K		
Identification and Listing of Hazardous Waste	40 CFR Part 261	Defines characteristics of hazardous wastes and provides lists of hazardous wastes. Identifies solid wastes that are subject to regulation as hazardous wastes under 40 CFR Parts 124, 262-265, 268, 270, and 271.	Applicable to wastes generated by remedial activities, including investigation-derived wastes, excavated soil, or solid wastes generated by treatment of soil or hazardous wastes. Relevant and appropriate for contaminated soil at the site.
RCRA Facility Investigation Guidance	EPA 1989	Guidance levels for cleanup of contaminated soils based on EPA-derived chronic exposure assumptions; intended as screening levels at RCRA facilities to determine if a more detailed health-risk evaluation is warranted.	TBC for detected soil contamination.
Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities (Proposed Rule)	55 FR 30798 27 July 1990	Risk-based action levels for contaminants in soil which, if exceeded, would trigger the need for a Corrective Measures Study.	TBC for detected soil contamination.
Clean Air Act (CAA), as amended	42 USCA Sect. 7401-7671Q		
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes ambient air quality standards for certain "criteria pollutants" to protect public health and welfare.	Applicable. Would be considered as part of a permit application for emissions of air pollutants from on-site treatment processes.
Standards of Performance for New Stationary Sources	40 CFR Part 60	Provides emission standards for certain industrial activities.	Relevant and appropriate if pollutants addressed by the regulations are emitted due to remedial actions at

TABLE B-1

POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
			the site.
National Emission Standards for Hazardous Air Pollutants	40 CFR Part 61	Provides standards for emissions of hazardous air pollutants from certain activities. Subpart M contains the National Emission Standard for Asbestos, and defines asbestos-containing waste materials and regulated asbestos containing materials (RACM).	Applicable if asbestos-containing waste materials or RACM are present. Relevant and appropriate if pollutants addressed by NESHAPS are emitted due to remedial actions at the site that do not involve listed activities.
Residential Lead-Based Paint Hazard Reduction Act of 1992	P.L. 102-550		
Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (June 1995)		Establishes hazard levels for lead in bare soil: 2000 ppm (building perimeter and yard) and 400 ppm (high contact areas, such as playgrounds and gardens).	TBC for determining whether lead concentrations in soil present a hazard.
Toxic Substance Control Act (TSCA), as amended	7 U.S.C. Sect. 136 *et seq.*		
Identification of Dangerous Levels of Lead; Proposed Rule	63 FR 30301	Soil containing lead in excess or 2,000 ppm is defined as a soil lead hazard, for purposes of lead-based paint abatement activities.	TBC for determining whether lead concentrations in soil present a hazard.
Lead-Based Paint Poisoning Prevention In Certain Residential Structures	40 CFR 745	References clearance levels for lead-contaminated soil.	TBC for determining whether lead concentrations in soil present a hazard.
Asbestos-Containing Materials in Schools	40 CFR 763.83	Defines asbestos-containing material as any material or product which contains more than 1 percent asbestos	TBC for determining whether asbestos concentrations in soil present a hazard.

TABLE B-1

POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
State			
Nebraska Environmental Protection Act	Neb. Rev. Stat., Chapter 81	State's policy on environmental control.	
Rules and Regulations Governing Hazardous Waste Management in Nebraska	Neb. Adm. Rules & Regs., Title 128	Defines characteristics of hazardous wastes and provides lists of hazardous wastes. Identifies solid wastes which are subject to regulation as hazardous wastes.	Applicable to wastes generated by remedial activities, including investigation-derived wastes, excavated soil, or solid wastes generated by treatment of soil or hazardous wastes.
Ground Water Quality Standards and Use Classification	Neb. Adm. Rules & Regs., Title 118	Addresses investigation and cleanup of petroleum contamination. Proposed risk-based corrective action (RBCA) regulations will define action levels.	TBC for petroleum-contaminated soil on site.
Air Pollution Control Rules and Regulations	Neb. Adm. Rules & Regs., Title 129, Chapter 4	Establishes Primary and Secondary Ambient Air Quality Standards for particulate matter, sulfur dioxide, carbon monoxide, ozone, and lead.	Applicable if regulated pollutants (e.g. particulates) are discharged to the atmosphere during remedial action.
	Neb. Adm. Rules & Regs., Title 129, Chapter 5	Establishes criteria for obtaining a permit to operate a source of potential emissions of hazardous air pollutants, volatile organic compounds, and particulate matter.	May be applicable for alternatives involving emissions of regulated pollutants from treatment processes.
	Neb. Adm. Rules & Regs., Title 129, Chapter 17	Establishes criteria for obtaining a permit to construct or modify a source of potential emissions of hazardous air pollutants, volatile organic compounds, and particulate matter.	May be applicable for alternatives involving emissions of regulated pollutants from treatment processes.

TABLE B-1

POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
	Neb. Adm. Rules & Regs., Title 129, Chapter 19	Adopts 40 CFR Sect. 52.21 regarding Prevention of Significant Deterioration of Air Quality.	Applicable. Would be considered as part of the process for establishing emissions limitations of air pollutants from on-site treatment processes (e.g., incineration).
	Neb. Adm. Rules & Regs., Title 129, Chapter 23, Hazardous Air Pollutants: Emission Standards	Adopts 40 CFR 61 (NESHAPS).	Applicable if asbestos containing waste materials or RACM are present. Relevant and appropriate if pollutants addressed by NESHAPS are emitted due to remedial actions at the site that do not involve listed activities.
	Neb. Adm. Rules & Regs., Title 129, Chapter 32	Prohibits visible emissions of fugitive particulate matter beyond the premises where it originates.	Applicable if remedial activities, such as soil excavation, generate fugitive dust.
Asbestos Control Act	Nebraska Revised Statutes, §§71-6301 to 71-6317		
Regulations and Standards Governing Asbestos Projects	Nebraska Department of Health Regulations, Title 178, Chapter 22	Defines asbestos containing materials as any material or product containing over 1% asbestos.	Applicable if remediation activities involve soil or other materials containing greater than 1% asbestos.

Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead Contaminated Soil

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Federal			
Solid Waste Disposal Act (SWDA), as amended	42 USCA Sect. 6901-6992K		
Criteria for Classification of Solid Waste Disposal Facilities and Practices (Subtitle D)	40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health, and thereby constitute prohibited open dumps.	Relevant and appropriate for on-site closure of contaminated soils.
Criteria for Municipal Waste Landfills (Subtitle D)	40 CFR Part 258	Sets forth minimum criteria for municipal solid waste landfills, including design, operation, monitoring, corrective action, closure, and post-closure care requirements.	Corrective action and closure requirements are relevant and appropriate, although the Subtitle C requirements listed below are more stringent.
Hazardous Waste Management Systems General (Subtitle C)	40 CFR Part 260	Provides definitions, general standards, and information applicable to 40 CFR Parts 260-265, 268.	Applicable for remedial actions that involve management of hazardous waste, such as contaminated debris or investigation-derived waste.
Identification and Listing of Hazardous Wastes (Subtitle C)	40 CFR Part 261	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	Applicable for remedial actions that involve the need to determine whether hazardous wastes, such as contaminated debris or investigation-derived waste, are being managed on-site.
Standards Applicable to Generators of Hazardous Waste (Subtitle C)	40 CFR Part 262	Establishes standards for generators of hazardous waste.	Applicable for remedial actions that involve off-site disposal or treatment of hazardous waste. On-site generation triggers selected provisions (i.e., waste determination, accumulation time).

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Standards Applicable to Transporters of Hazardous Waste (Subtitle C)	40 CFR Part 263	Establishes standards that apply to transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	Applicable for remedial actions that involve off-site transportation of hazardous waste, such as contaminated debris or investigation-derived waste.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (Subtitle C)	40 CFR Part 264	Establishes minimum national standards that define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or disposal hazardous waste.	Applicable for remedial actions that involve on-site treatment or disposal of hazardous waste.
	40 CFR 264.111	Establishes performance standards for closure of permitted facilities. Closure must minimize the need for further maintenance, and control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere	Relevant and appropriate for site closure.
	40 CFR 264, Subpart S	Addresses corrective action at solid waste management units (SWMUs). Establishes requirements for corrective action management units (CAMUs) and temporary units (TUs) for management of remediation wastes during remediation activities.	Applicable if containerized or un-containerized remediation wastes, such as excavated soil, would be managed (treated, stored, or disposed) on site. These regulations waive some of the procedural and technical requirements that would otherwise apply to a new SWMU.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Interim Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities (Subtitle C)	40 CFR Part 265	Establishes minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or if the facility is subject to post-closure requirements, until post-closure responsibilities are fulfilled.	Relevant and appropriate, but less stringent than the Part 264 standards.
Standards for the Management of Specific Hazardous Wastes and Specific types of Hazardous Waste Management Facilities	40 CFR Part 266	Establishes requirements, which apply to recyclable materials that, are recovered or disposed on the land.	Relevant and appropriate for any lead-contaminated materials that may be recycleable.
Land Disposal	40 CFR Part 268	Identifies hazardous wastes restricted from land disposal and treatment standards for restricted wastes and waste treatment residuals.	Relevant and appropriate if closure of the site involves on-site closure of contaminated soils.
Hazardous Waste Permit Program	40 CFR Part 270	Establishes provisions covering basic EPA permitting requirements.	Not an ARAR. No RCRA Subtitle C permit is required for closure of the site.
Underground Storage Tanks	40 CFR Part 280 RCRA Subtitle I	Establishes regulations for underground storage tanks used to contain petroleum or other regulated substances (as defined at 40 CFR 280.12). Includes requirements for site investigations and corrective action plans.	Relevant and appropriate for corrective actions addressing petroleum-contaminated soil.
Safe Drinking Water Act	42 USCA Sect. 300(f) et seq.		
Standards for Owners and Operators of Public Water Supply System	40 CFR Part 141	Establishes primary drinking water regulations, including treatment (water quality) requirements for public water supply systems.	Not an ARAR or TBC.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Underground Injection Control Regulations	40 CFR Parts 144-147	Establishes permitting requirements for injection wells to provide for protection of underground sources of drinking water.	Not an ARAR or TBC.
Clean Water Act	33 USCA Sect. 1251-1376		
National Pollutant Discharge Elimination System	40 CFR Parts 122, 125	Requires permits for the discharge of pollutants from any point source into waters of the United States.	Not an ARAR. Potential remedies do not involve discharge from treatment systems.
	40 CFR Sect. 122.26(b)(14)(x)[1]	Requires that storm water runoff be monitored and controlled on construction sites greater than five acres.	Applicable if the remediation site is greater than five acres, relevant and appropriate for smaller sites.
National Pretreatment Standards	40 CFR Part 403	Sets pretreatment standards to control pollutants that pass through or interfere with treatment processes in publicly owned treatment works (POTW) or which may contaminate sewage sludge.	Not an ARAR. Potential remedies do not involve discharge to a POTW.
Marine Protection Research, and Sanctuaries Act of 1972	16 USCA Sect. 1431-1445 33 USCA Sect. 1401-1445, 1447	Regulates ocean dumping.	Not an ARAR. Remedial action will not involve ocean dumping.
Residential Lead-Based Paint Hazard Reduction Act of 1992	P.L. 102-550		
Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (June 1995)		Establishes recommended abatement or interim control measures for lead-contaminated soil: >2000 ppm (building perimeter and yard) and >400 ppm (high contact areas, such as playgrounds and gardens).	TBC for determining the appropriate response actions where lead-contaminated soil is present.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Toxic Substances Control Act (TSCA)	15 USCA Sect. 2601-2692		
Lead-Based Paint Poisoning Prevention In Certain Residential Structures	40 CFR 745	Includes requirements for abatement of lead-contaminated soil.	Relevant and appropriate for abatement of lead-contaminated soil.
Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, And Use Prohibitions	40 CFR Part 761	Establishes storage and disposal requirements for PCBs.	Not an ARAR. Remedial action will not involve handling of PCBs.
Asbestos	40 CFR Part 763	Establishes requirements for inspection of asbestos containing materials and abatement, if necessary, in elementary or secondary school buildings. Includes requirements for transport and disposal of asbestos-containing wastes.	Relevant and appropriate for management of asbestos-contaminated soil and debris.
	15 USCA Sect. 2669	Establishes requirements for radon studies and abatement, including federal buildings.	Not an ARAR. Remedial action will not involve radon.
Clean Air Act (CAA), as amended	42 USCA Sect. 7401-7671Q		
Approval and Promulgation of Implementation Plans	40 CFR 52, Subpart CC, Nebraska	Establishes Air Quality Control Regions and attainment dates for national standards in those regions.	Applicable if remedial activities involve air emissions, e.g., excavation.
New Source Performance Standard, Municipal Solid Waste Landfills	40 CFR Part 60, Subpart WWW	Rule for control of non-methane organic compounds (NMOC's) from municipal solid waste landfills emitting > 167 TPY NMOC's and with maximum design capacity of ≥ 111,000 T.	TBC for alternatives that propose leaving petroleum-contaminated soil on-site.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
National Emission Standards for Hazardous Air Pollutants	40 CFR Part 61	Provides standards for emissions of hazardous air pollutants from certain activities. Subpart M contains the National Emission Standard for Asbestos, and defines asbestos-containing waste materials and regulated asbestos containing materials (RACM). Contains requirements for asbestos disposal procedures and for asbestos disposal sites.	Applicable if a listed activity, such as a demolition or renovation project involving asbestos is carried out. Applicable if asbestos containing waste materials or RACM are present. Relevant and appropriate for activities involving excavation of asbestos-containing waste. Relevant and appropriate if pollutants addressed by NESHAPS are emitted due to remedial actions at the site that do not involve listed activities.
Hazardous Materials Transportation Act	40 USCA Sect. 1801-1813		
Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.	Applicable for remedial actions that involve off-site transportation of hazardous materials.
Occupation Safety and Health Act of 1970	PL 91-596 29 USCA Sect. 651-678		
Occupational Safety and Health Standards	29 CFR Part 1910	Establishes safety and health requirements for personnel working with hazardous materials and hazardous waste.	Applicable to on-site remedial activities.
Safety and Health Regulations for Construction	29 CFR Part 1926	Establishes protection standards (e.g., hazard communication, excavation and trenching requirements) for workers involved in hazardous waste operations.	Applicable to on-site remedial activities.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
State			
Nebraska Environmental Protection Act	Neb. Rev. Stat., Chapter 81 Article 15		
Nebraska Surface Water Quality Standards	Nebr. Adm. Rules & Regs., Title 117	Establishes water quality standards and criteria for the surface waters of the state.	Applicable if contaminants leach from the soil to surface waters.
Ground Water Quality Standards and Use Classification	Neb. Adm. Rules & Regs., Title 118	Provides groundwater remedial actions protocol for point source groundwater pollution; defines Remedial Action Classes (RACs) with basic requirements for remedial action. Proposed risk-based corrective action (RBCA) regulations will define action levels.	Not an ARAR. This operable unit does not include groundwater pollution. RBCA remedial action requirements for petroleum-contaminated soil are TBC.
Petroleum Contaminated Soils Protocol for the Leaking Underground Storage Tank Program	(not promulgated as a regulation)	Provides guidance for soil investigation and cleanup at LUST sites.	TBC for corrective actions addressing petroleum-contaminated soil.
Rules and Regulations Pertaining to the Issuance of Permits under the NPDES	Neb. Adm. Rules & Regs., Title 119	Requires permit for discharging pollutants from a point source into the waters of the State.	Not an ARAR. Site activities will not involve point source discharges to surface water.
Effluent Guidelines and Standards	Neb. Adm. Rules & Regs., Title 121	Establishes point source effluent standards and secondary treatment standards for industries.	Not an ARAR. Site activities will not involve point source discharges to surface water.
Rules and Regulations for Underground Injection and Mineral Production Wells	Neb. Adm. Rules & Regs., Title 122	Establishes procedures for permitting underground injection of hazardous wastes into or above an underground supply of drinking water.	Not an ARAR. Site activities will not involve alternatives proposing reinjection of treated groundwater.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Design, Operation, and Maintenance of Wastewater Treatment Facilities	Neb. Adm. Rules & Regs., Title 123	Establishes procedures for the design, operation, and maintenance of wastewater treatment works, including the submittal of plans, receipt of construction permits, and construction and testing requirements.	Not an ARAR. Site activities will not involve on-site treatment of extracted groundwater.
Design, Operation, and Maintenance of Septic Tanks	Neb. Adm. Rules & Regs., Title 124	Establishes procedures for the design, operation, and maintenance of septic tank systems including permitting, design criteria, testing, site layout, construction, maintenance, allowable waste types and abandonment.	Not an ARAR. Remedial action will not involve septic tanks.
Design, Operation, and Maintenance of Individual Waste Treatment Lagoons	Neb. Adm. Rules & Regs., Title 125	Establishes design, operation, and maintenance criteria for wastewater lagoons including design, construction, operation and maintenance.	Not an ARAR. Remedial action will not involve wastewater lagoons.
Rules and Regulations Pertaining to the Management of Wastes	Neb. Adm. Rules & Regs., Title 126	Requires permits for licenses for various waste management activities and establishes policy for releases of oil or hazardous substances and remediation of such releases.	Relevant and appropriate. Substantive requirements for spills/releases and remediation of spills/releases are given in Title 118 and Title 128.
Rules and Regulations Governing the Nebraska Pretreatment Program	Neb. Adm. Rules & Regs., Title 127	Establishes limitations on types of wastes which can be discharged to a POTW and requires a permit when a discharge may interfere with, pass through, or be incompatible with a POTW's treatment process.	Not an ARAR. Site activities will not involve discharges of contaminated groundwater to a POTW.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
Rules and Regulations Governing Hazardous Waste Management in Nebraska	Neb. Adm. Rules & Regs., Title 128	Establishes procedures for notification of hazardous waste activity, identification and listing of hazardous wastes, generators, and operators of treatment, storage, and disposal facilities.	Substantive requirements that are the same or more stringent than 40 CFR 261, 262, 263, 264, 268, 270 are applicable.
Air Pollution Control Rules and Regulations	Neb. Adm. Rules & Regs., Title 129, Chapter 2	Defines "major source" of hazardous air pollutants and major stationary sources of other pollutants, including fugitive dust and other particulate emissions.	Applicable to remedial activities generating fugitive dust, and potentially applicable to remedial alternatives involving volatilization or incineration.
	Neb. Adm. Rules & Regs., Title 129, Chapter 5	Establishes criteria for obtaining a permit to operate a source of potential emissions of hazardous air pollutants, volatile organic compounds, and particulate matter.	Substantive requirements are potentially applicable to remedial alternatives involving volatilization or excavation.
	Neb. Adm. Rules & Regs., Title 129, Chapter 22	Establishes emission limits for new incinerators and lists emission report contents.	Not an ARAR. Site activities will not involve incineration of hazardous wastes.
	Neb. Adm. Rules & Regs., Title 129, Chapter 16	Requires good engineering practice in design of the stack height.	Not an ARAR. Site activities will not involve incineration of hazardous wastes.
	Neb. Adm. Rules & Regs., Title 129, Chapter 17	Establishes criteria for obtaining a permit to construct or modify a source of potential emissions of hazardous air pollutants, volatile organic compounds, and particulate matter.	Substantive requirements are applicable to remedial alternatives involving volatilization or excavation.
	Neb. Adm. Rules & Regs., Title 129, Chapter 20	Prohibits visible dust beyond the limits of the property line where handling, transportation, or construction is taking place.	Applicable to remedial activities generating fugitive dust.

TABLE B-2

POTENTIAL ACTION-SPECIFIC ARARs/TBCs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Comment
	Neb. Adm. Rules & Regs., Title 129, Chapter 39	Limits visible emissions from diesel-powered vehicles on public streets or highways.	Applicable only when diesel-powered vehicles used during remedial activities are on public streets or highways.
Rules and Regulations Pertaining to Solid Waste Management	Neb. Adm. Rules & Regs., Title 132	Establishes policy for licensing, locating, constructing, operating, and closing of solid waste facilities.	Applicable for alternatives involving the on-site disposal/closure of treated waste or soil.
Rules and Regulations Concerning Underground Storage Tanks in the State of Nebraska, State Fire Marshall's Office	Neb. Adm. Rules & Regs., Title 159	Applies to the operation, maintenance, installation, closure on use of underground tanks containing petroleum products and hazardous substances not classified as hazardous waste under RCRA Subtitle C.	Relevant and appropriate for corrective actions addressing petroleum-contaminated soil.
Regulations Governing Licensure of Water Well and Pump Installation Contractors and Certification of Water Well Drilling, Pump Installation, and Water Well Monitoring Supervisors[1]	Neb. Adm. Rules & Regs., Title 178, Chapter 10	Contains rules governing the qualifications of contractors installing water wells.	Not an ARAR. Site activities will not involve installation of monitoring wells, extraction of recovery wells, and the installation of pumps.
Regulations Governing Water Well Construction, Pump Installation, and Water Well Abandonment Standards	Neb. Adm. Rules & Regs., Title 178, Chapter 12	Contains rules governing water well construction and abandonment and pump installation.	Not an ARAR. Site activities will not involve installation of monitoring wells, extraction of recovery wells, and the installation of pumps.

TABLE B-3

POTENTIAL LOCATION-SPECIFIC ARARs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comments
Federal			
Floodplain Management	Executive Order 11988 40 CFR Part 6, Appendix A and 40 CFR Part 6.302	Limits activities in a floodplain, which is defined as "the lowland and relatively flat areas adjoining inland and coastal waters including at a minimum that area subject to a 1 percent or greater chance of flooding in any given year" (the 100-year floodplain)	TBC. The site is located in the 100-year floodplain, although it is protected from the 100-year flood by a levee.
Protection of Wetlands	Executive Order 11990 40 CFR Part 6, Appendix A	Addresses possible impacts of construction of facilities or management of property in wetlands; must avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.	Not an ARAR. No designated wetlands occur at proposed on-site remedial action locations.
Safe Drinking Water Act	42 USCA 300f et seq.		
Underground Injection Control Program: Criteria and Standards	40 CFR Part 146	Sets criteria for underground injection wells, including those used to inject treated wastes from RCRA or CERCLA cleanup actions. These regulations address how close injection wells may be placed to underground sources of drinking water.	Not an ARAR. No injection of treated wastes is proposed at this site.
Sole Source Aquifers	40 CFR Part 149	Includes regulations for defining sole or principal drinking water source aquifers	Not an ARAR. No sole source aquifer has been designated in this area.
Wellhead Protection Program	42 USCA 300h-7	1986 SDWA amendments direct States to implement programs to protect wells and recharge areas for drinking water wells.	Not an ARAR. No wellhead protection areas are located in this area.

TABLE B-3

POTENTIAL LOCATION-SPECIFIC ARARs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comments
Water Pollution Control Act, as amended	33 USCA Sect. 1251 et seq. (CWA Section 404) 40 CFR Part 230, 33 CFR Parts 320-330	Prohibits discharge of dredged or fill material into wetlands (as defined in U.S. Army Corps of Engineers regulations) without permit.	Not an ARAR. No dredged or fill material will be placed into a wetland.
Wilderness Act	16 USCA Sect. 1131 et seq.; 50 CFR Part 35.1 et seq.	Federally-owned area designated as wilderness area must be administered in such a manner that will leave it unimpaired as wilderness and to preserve its wilderness.	Not an ARAR. No federally-owned wilderness area is located on site or in the vicinity of the site.
Wildlife Refuge	16 USC 668 et seq; 50 CFR Part 27	Limits actions allowed in areas designated as part of National Wildlife Refuge System.	Not an ARAR. The site is not a national wildlife refuge.
Solid Waste Disposal Act (SWDA), as amended	42 USCA Sect. 6901-6992K		
Faults	40 CFR Part 264.18(a)	New RCRA treatment, storage, or disposal of hazardous waste prohibited within 61 meters of a fault displaced in Holocene time.	Not an ARAR. No fault has been identified that underlies the site.
Floodplains	40 CFR Part 264.18(b)	RCRA treatment, storage, or disposal facility must be designed, constructed, operated, and maintained to avoid washout within 100-year floodplain.	TBC. Proposed remedial actions occur in the 100-year floodplain, although the site is protected from the 100-year flood by a levee.
Salt Domes, Caves, Mines	40 CFR Part 264.18(c)	Placement of noncontainerized or bulk liquid RCRA hazardous waste prohibited within salt dome formation, underground mine, or cave.	Not an ARAR. These activities will not be implemented; also, these types of formations are not known to be present in the vicinity.

TABLE B-3

POTENTIAL LOCATION-SPECIFIC ARARs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comments
Endangered Species Act	16 USCA Sect. 1531 to 1544 50 CFR Part 200 50 CFR Part 402	Protects endangered species and the critical habitats upon which endangered species depend.	Not an ARAR. No critical habitats exist on the site; thus, no effect on endangered species expected from any remedial action.
Fish and Wildlife Coordination Act	16 USCA Sect. 661 et seq. 33 CFR Parts 320-330 40 CFR Part 6.302	Provides for protection of fish or wildlife if proposed action involves diversion, channeling, or other activity that modifies a stream or river.	Not an ARAR. No proposed remedial action will modify a stream or river.
Coastal Zone Management Act	16 USCA Sect. 1451 to 1464	Activities affecting the coastal zone, including lands therein and thereunder, and adjacent shore lands must be conducted in a manner consistent with approved state management programs.	Not an ARAR. No coastal zone present.
Coastal Barrier Resources Act	16 USCA Sect. 3501 et seq.	Prohibits any new federal expenditure within the coastal barrier resource system.	Not an ARAR. No coastal area present.
Wild and Scenic Rivers Act	16 USCA 1271 et seq., 40 CFR 6.302(e)	Limits actions that will have direct adverse effect on scenic river as specified in Section 1276(a).	Not an ARAR. No designated scenic or wild rivers are located near the site.
Archaeological and Historic Preservation Act of 1974	16 USCA Sect. 469; 36 CFR Part 65	Must recover and preserve artifacts in area where alteration of terrain threatens significant scientific, prehistoric, historic, or archaeological data.	Not an ARAR. No historic site located on site.
National Historic Preservation Act of 1966, as amended	16 USCA Sect. 470 et seq. 36 CFR Part 800 40 CFR Sect. 6.301	Must preserve property in or eligible for National Register of Historic Places; actions should minimize harm to National Historic Landmarks.	Not an ARAR. No historical place or landmark identified on site.

TABLE B-3

POTENTIAL LOCATION-SPECIFIC ARARs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comments
Native American Graves Protection and Repatriation Act[1]	PL 101-601	Requires that if Native American remains or cultural items are found on federal lands, the appropriate tribe must be notified, and all activity in the area of discovery must cease for at least 30 days.	Applicable if Native American remains or cultural items are found during remedial activities.
Antiquities Act of 1906[1]	16 USCA 431-433 43 CFR Part 3	Provides for protection of historic and prehistoric ruins and objects on Federal lands.	Applicable if historical ruins or objects are found during remedial activities.
State			
Nebraska Endangered & Threatened Species Regulations	Neb. Adm. Rules & Regs., Title 163, Chapter 6	Regulations developed under the Nongame and Endangered Species Conservation Act, governing the protection, conservation and management of endangered and threatened wildlife species.	Not an ARAR. No state-listed species are present on the site or will be adversely affected.
Nebraska Human Burial Sites Act	Neb. Rev. Stat., Article 12, Sections 12-1201 to 1212.	Provides protection for unmarked human burial sites on private and public lands.	Not an ARAR. No human burial sites are located on site.
Nebraska Environmental Protection Act	Neb. Rev. Stat., Chapter 81		
Nebraska Air Pollution Control Rules and Regulations	Neb. Adm. Rules & Regs., Title 129, Chapter 3	Establishes air quality control regions, upon which determinations of attainment of National Ambient Air Quality Standards (NAAQS) are based. The site is located in the Omaha-Council Bluffs Interstate Air Quality Control Region.	Applicable to remedial activities generating emissions of regulated pollutants.

TABLE B-3

POTENTIAL LOCATION-SPECIFIC ARARs
UNION PACIFIC RAILROAD OMAHA SHOPS, OPERABLE UNIT 1 (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comments
Rules and Regulations Pertaining to Solid Waste Management	Neb. Adm. Rules & Regs., Title 132, Chapter 4	Includes location standards for siting new solid waste disposal facilities. Hazardous waste is regulated as a subset of solid waste.	Relevant and appropriate for construction of a soil cover over the contaminated soil.
Floodplains	Neb. Rev. Stat., Chapter 31, Article 10, Neb. Adm. Rules & Regs., Title 455, Chapters 1 through 7.	Regulates, and requires permits for, certain activities proposed to take place in a floodplain.	TBC. Proposed remedial actions occur in the 100-year floodplain, although the site is protected from the 100-year flood by a levee.

To Be Inserted When Completed

COST ESTIMATE METHODOLOGY

The information presented in these cost estimates is used to compare alternatives. Unit prices and general cost information were obtained from cost estimating references (R.S. Means 1999), cost estimates for similar work, vendor quotes, guidance documents, and engineering judgment.

Corrective measure cost estimates are intended to provide an accuracy range of –30 to +50 percent of actual cost. The actual project cost will depend on actual labor and material cost, productivity, competitive market conditions, actual project scope and schedule, and other variable factors. As a result of these factors, the actual project cost is likely to vary from the estimates provided in this study. Funding needs should be carefully evaluated, taking these factors into consideration before budgets are established.

Costs include capital costs, operation and maintenance costs, and total present worth cost of each corrective measure alternative.

Capital Costs

Capital costs are expenditures required to construct or install the corrective action. Capital costs include only the expenditures that are initially incurred to implement an action and major expenditures in future years. They do not include the costs required to operate and maintain the action throughout its lifetime.

Operation and Maintenance Costs

O&M costs are the post-constructive/installation costs necessary to ensure or verify the continued effectiveness of a corrective action. They include all labor, equipment, and material costs associated with activities such as monitoring, operating, and maintaining extraction, containment, or treatment systems and disposal of residuals.

Other Costs

Other costs that were added to capital and O&M costs are contingencies and professional/ technical support. Contingencies cover unknowns, unforeseen circumstances, or unanticipated conditions that cannot be determined from the known data. The two types of contingencies are scope and bid. Scope contingencies cover costs due to scope changes that may occur during design. Bid contingencies cover unknown costs associated with constructing or implementing the project scope.

Professional/technical support are nonconstruction or implementation costs that do not fall under any one line item cost. They include costs associated with project management, legal services, engineering design, construction management, and all other professional/technical services needed to support the action.

Present Worth Cost

Present worth is the amount of money needed in the base year to cover the future costs associated with a particular time period at a particular interest or discount rate. Computation of present worth allows for the evaluation and comparison of future costs discounted to a base year. For this estimate, a discount rate of 7 percent was used. The base year for the estimate is 2006.

TABLE D-1

SUMMARY OF COSTS FOR OU2
ALTERNATIVE 1b - NO ACTION WITH INSTITUTIONAL CONTROLS
UPRR - OMAHA SHOPS

	Alternative 1b No Action with Institutional Controls
Capital Costs	$14,310
Annual O&M Costs	$3,881
O&M Years	15
Total Present Worth Costs	$54,596

TABLE D-1.1

SUMMARY OF CAPITAL COSTS
OU2 ALTERNATIVE 1b - NO ACTION WITH INSTITUTIONAL CONTROL
UPRR - OMAHA SHOPS

Alternative:	1b - No Action with Institutional Control	Expected Accuracy Range:	+50% to -30%
Description:	Institutional Controls	Present Worth Discount Rate:	7%
Site:	UPRR - Omaha Shops	Base Year of Estimate:	2006
Location:	Omaha, NE	Capital Cost Years:	0
Date Prepared:	February 16, 2006	O&M Cost Years:	N/A

DESCRIPTION	QTY	UNIT	UNIT COST	COST	TOTALS	NOTES
CAPITAL COSTS (YEAR 0):						
1 **Main Sitework**						
a. Institutional Controls	1	LS	$10,000.00	$10,000		
SUBTOTAL				$10,000		
SUBTOTAL 1					$10,000	
Contingency (% of Subtotal 1)		35%		$3,500		20% scope + 15% bid
SUBTOTAL 2					$13,500	
Project Management and Support (% of Subtotal 2)						
a. Project Management		3%		$405		
b. Engineering / Design		2%		$270		
c. Construction Management		1%		$135		
SUBTOTAL				$810		
TOTAL COSTS					$14,310	

TABLE D-1.2

SUMMARY OF OPERATION AND MAINTENANCE COSTS
OU2 ALTERNATIVE 1b - NO ACTION WITH INSTITUTIONAL CONTROL
UPRR - OMAHA SHOPS

Alternative ID:	1b - No Action with Institutional Controls	Expected Accuracy Range:	+50% to -30% (feasibility study)
Description:	Institutional Controls	Present Worth Discount Rate:	7%
Site ID:	UPRR - Omaha Shops	Base Year of Estimate:	2006
Location:	Omaha, NE	Capital Cost Years:	0
Date Prepared:	February 13, 2006	O&M Cost Years:	1-15

DESCRIPTION	QTY	UNIT	UNIT COST	COST	TOTALS	NOTES
ANNUAL O&M COSTS (YEARS 1-15):						
1 **Site Maintenance**						
a. Site Maintenance	50	HR	$50.00	$2,500		Approximately 4 hr/mo
				$2,500		
SUBTOTAL 1					$2,500	
Contingency (% of Annual O&M Cost Subtotal)		35%		$875		20% scope + 15% bid
SUBTOTAL 2					$3,375	
Project Management and Support (% of Subtotal 2)						
a. Project Management		5%		$169		
b. Technical Support		10%		$338		
SUBTOTAL				$506		
TOTAL ANNUAL O&M COST (YEARS 2-15)					**$3,881**	

TABLE D-1.3

SUMMARY OF PRESENT WORTH COSTS
OU2 ALTERNATIVE 1b - NO ACTION WITH INSTITUTIONAL CONTROLS
UPRR - OMAHA SHOPS

Alternative ID:	1b - No Action with Institutional Controls	Expected Accuracy Range:	+50% to -30% (feasibility study)
Description:	Institutional Controls	Present Worth Discount Rate:	7%
Site ID:	UPRR - Omaha Shops	Base Year of Estimate:	2006
Location:	Omaha, NE	Capital Cost Years:	0
Date Prepared:	February 13, 2006	O&M Cost Years:	1-15

YEAR	CAPITAL COST	ANNUAL O&M COST	TOTAL COST	DISCOUNT FACTOR (7%)	PRESENT WORTH	CUMULATIVE O&M PRESENT WORTH
0	$14,310		$14,310	1.000	$14,310	
1		$3,881	$3,881	0.952	$3,696	$3,696
2		$3,881	$3,881	0.907	$3,520	$7,217
3		$3,881	$3,881	0.864	$3,353	$10,570
4		$3,881	$3,881	0.823	$3,193	$13,763
5		$3,881	$3,881	0.784	$3,041	$16,804
6		$3,881	$3,881	0.746	$2,896	$19,700
7		$3,881	$3,881	0.711	$2,758	$22,458
8		$3,881	$3,881	0.677	$2,627	$25,085
9		$3,881	$3,881	0.645	$2,502	$27,587
10		$3,881	$3,881	0.614	$2,383	$29,970
11		$3,881	$3,881	0.585	$2,269	$32,239
12		$3,881	$3,881	0.557	$2,161	$34,400
13		$3,881	$3,881	0.530	$2,058	$36,459
14		$3,881	$3,881	0.505	$1,960	$38,419
15		$3,881	$3,881	0.481	$1,867	$40,286
TOTALS	$14,310	$58,219	$72,529		$54,596	
TOTAL PRESENT WORTH COST					**$54,596**	